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WOODHAWK BOTANICAL SURVEY

FERGUS COUNTY, MONTANA

LEWISTOWN DISTRICT OF THE BUREAU OF LAND MANAGEMENT

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EXECUTIVE SUMMARY

A botanical survey covering sensitive plant species and plant communities was conducted in the Woodhawk allotment of the Bureau of Land Management (BLM). The results contribute to effective land management, to a model for allotment management planning on the Missouri River corridor and the Lewistown District, and to statewide botanical information.

Two populations of the BLM watch species, little Indian breadroot (*Psoralea hypogaea*) were documented, and are part of the new information used to rerank it from "S1" (critically imperiled in the state) to S2 (imperiled in the state). Recurrent stands of the BLM watch plant community, *Pinus ponderosa/Carex heliophila*, were sampled and descibed. Five plant associations of potential concern to the state were sampled and two more were qualitatively described among the 20 communities present. Rank changes are recommended for five of them.

The highest priority activity for each of the documented biodiversity features is to expand the scope of survey. One plant assocociation, *Pseudotsuga menziesii/Oryzopsis micrantha* p.a., is recommended for inclusion to the BLM watch list, and two plant associations are recommended for deletion from the list. There are no features recommended for sensitive status since there are no imminent management impacts to the features under current conditions, though they may be vulnerable to activities which would intensify on-site land use or promote spread of noxious weeds.

The highest biodiversity significance identified in the Woodhawk study area rests in the composite community heterogeneity of the Missouri Breaks landscape rather than in the global or state rarity of the components. In general, the Woodhawk allottment possesses a high number of plant community types for an area its size, including a wide range of successional plant associations. It also has several plant community types typical for eastern Montana which have not been well-documented in the state ecological literature. In this way, it provides a major new baseline of botanical survey information for the Missouri River corridor. The methodology employed in this study, in abbreviated form, is presented as a template for routine project reviews.

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INTRODUCTION

The Woodhawk Allotment is located in the Lewistown District of the Bureau of Land Management (BLM). This study area is the subject of a model allotment management plan. Information on BLM special status species and community types are among the bodies of natural resource data brought into management planning for contributing to understanding and management of its resources.

Absence of botanical information characterizes the Woodhawk study area and large areas of the Lewistown District. Botanical information provides information to fine tune management plans and evaluate the agency-administered lands from state and national biodiversity perspectives. The multiple goals of this project were to survey for sensitive botanical features including both sensitive species and community types, and to develop widely-applicable botanical tools for doing management planning with limited background information.

This is consistent with the new interim BLM guidelines on special status species management (USDI BLM 1996) which provide a framework to:

A. Determine which plant taxa and plant community types are imperiled and which occur on public lands.

B. Conserve, enhance, and maintain these taxa and types to perpetuity on BLM-administered surface.

C. Ensure that BLM management and other actions will not adversely impact these taxa and types.

D. Document those plants and plant community types that have been determined to not need protection.

BLM guidelines address the risk of bringing species and species' habitats to the brink of endangerment, and places a premium on informed actions.

We used these general guidelines, existing information resources, and intensive de novo field surveys to provide a body of site-specific botanical information and a framework for BLM personnel to address sensitive botanical resources elsewhere in the District.

STUDY AREA

The Woodhawk study area is located at the north end of Fergus County, in the Judith Resource Area of the Lewistown District (Figure 1). It spans over 50 square miles, bordered on the north by the Missouri River, and extending along app. 18 rivermiles of shore.

The study area is a tertiary watershed along the Missouri River corridor. It has a dissected Missouri Breaks landscape pattern as found along the Missouri River and tributaries. Woodhawk Creek flows eastward through the center of the study area and is a central landform (see photo in Appendix E). Elevation ranges from 2340 feet to 3220 feet, with the highest elevation at Reppe Butte, and the lowest elevation at the downstream end of the Missouri River in the southeast corner.

Its unglaciated landscape is carved out of Cretaceous sedimentary deposits which at the surface includes: the Bearpaw Shale, the Judith River formation, and the Claggett formation; listed from most to least extensive, respectively (from Ross et al. 1955). Shale is the prevailing bedrock in all three formations at the surface in the study area. A fine-grained sandstone caprock of the Judith River Formation outcrops intermittently in the study area along the Missouri River, plus a few localized buttes and knolls to the south. Clinker and concretions are uncommon.

A soils survey has been published for Fergus County (USDA Soil Conservation Service 1979). The prevailing soils are Ustic Torriorthents, i.e., azonal soils formed under hot, dry conditions. Most are montmorillonitic. Clays make up the prevailing rolling uplands (Thebo clay, 2-8 slopes and 8-25% slopes). The soils along the Missouri River and Woodhawk Creek valleys are mainly either shale (mapped as "rock outcrop"), clays (Neldore-Thebo clays, 4-25% slope and 25-60% slopes) or an outcrop complex (Dilts-Julin-Rock outcrop complex 15-50% slopes). The Missouri River bottoms are silty clay loams (Havre silty clay loam, and Kobar silty clay loam, gullied, 2-25% slope), while the Woodhawk Creek bottoms are Havre and Harlem soils, occasionally flooded. The prevailing soil series have little profile development, little organic matter accumulation, slow to very slow permeability, slow percolation, and low available water capacity. While most local soils are circumneutral to strongly alkaline, the Dilts series are acidic and the Julin series are strongly acidic.

Water erosion is an active, pervasive force because vegetation cover and litter are low throughout much of the area for the following reasons. The combination of low permeability and high shrink-swell behavior of the montmorillinite component is destabilizing and promotes slumping. The soils overlie soft sedimentary parent material that are already being eroded by sheet and rill erosion. Many of the precipitation events during the growing season are summer thunderstorms. Water erosion as evidenced by rills and gullies is most severe on bare slopes, including areas where fire has killed woody vegetation that has not recolonized. As a recent example, a fire burned in the late 1960s on Woodhawk Creek in Sections 21 and 22 of T.23N R.21E. The area has disproportionately high extent of unstable slopes, and tree regeneration is limited or wanting. Wind is a secondary erosion force. West winds blow straight down the Woodhawk Creek and the nearby Missouri River, filling the valleys with fine dust. Rains come out of the east, and the Little Rocky Mountains may cast a partial rainshadow, intercepting rainfall before it reaches this area. The dissected landscape and orientation of the valleys relative to prevailing winds further increase evapotranpiration and exaggerate microclimate aridity.

Despite the aridity, there are natural wetlands. This is attributed to the low permeability of the shale, and local conditions which foster moisture collection and drainage impediments. The most extensive wetland habitat is found associated with ephemeral streams that have headwater seeps. The headwater tributaries with impeded drainage are mainly on the south side of Woodhawk Creek in Sections 19-23. They support temporarily and seasonally inundated alkaline communites. There are also scattered, tiny saline seeps which are along lower valley slopes which also support seasonally inundated alkaline communities. There are small wetland basin catchments which have formed at midslope settings associated with slump blocks or other topographic irregularities. The best-developed examples were found in sections 25 and 26 east of Reppe Butte, with open water pools and brackish seasonally inundated communities, representing the least-alkaline of wetland communities. Finally, there are tiny upland swales that may correspond with buffalo wallows, and which are ephemerally inundated.

The Missouri River floods part of the bottoms in most years, despite upstream impoundments. Flooding is delayed to late in the spring or early summer, coinciding with peak mountain run-off. All other study area waterways are ephemeral, with few segments where springs and seeps maintain moist conditions. There are at least two study area impoundments above Woodhawk Creek which are greater than 5 acres, in addition to many smaller impoundments and stock pond developments.

Climate is continental, as indicated by metereological conditions recorded at Winifred (USDA Soil Conservation Service 1979). The total annual precipitation is 14.06 inches, which includes 41 average annual inches of snowfall. Much of the precipitation during the growing season comes with thundershowers. Thunderstorms occur on about 30 days each year. In summer, the average daily temperature is about 65 degrees Fahrenheit, and the average daily maximum temberature is about 80 degrees.

Sagebrush steppe vegetation prevails in uplands and lowlands, constituting the climax natural vegetation in most of the study area. This type has not been well-described apart from recent preliminary work (DeVelice et al. 1995), and it has not been mapped as a vegetation type in the state. The "Seasonal Land Cover Regions" mapped for the United States by EROS most closely demarcate sagebrush shrubland in Montana,and places the study area at outlying, western segments of a vegetation type centered in Valley County and adjoining counties. North and south of the study area, with increasing distance from the Missouri River, the prevailing vegetation is grassland.

Elsewhere in the study area, shrubs are common on the sparsely-vegetated slopes that border the Woodhawk Creek valley and Missouri River valley, and extensive slope segments are unvegetated. True grasslands are restricted mainly to sandy upland settings, and lowland outwash and floodplain, but can also be found in localized areas on midslope benches and slump blocks, and as successional plant associations after fire. Woodlands and forests are restricted mainly to the slopes of drainageways, especially on sheltered north-facing slopes. Their distribution also corresponds with that of an exceptionally acidic soils mapping unit, suggesting that the coniferous arboreal communities are better adapted to acidic soils than to other substrates, or that they are better competitiors to non-arboreal species under these conditions.

The observed vegetation differs from the characterization of potential plant communities ascribed to the primary soils series (USDA Soil Conservation Service 1979). Woody vegetation is not mentioned in characterizing potential vegetation, which is said to include combinations of western wheatgrass (*Agropyron smithii*), thickspike wheatgrass (*Agropyron dasystachyum*), bluebunch wheatgrass (*Agropyron spicatum*), and green needlegrass (*Stipa viridula*).

The Missouri River floodplain is open and broad, with very little cottonwood forest along this particular reach. The riparian corridor along the Missouri River has been intensively grazed, and has a patchwork history of homesteading and landuses associated with steamboat transportation like the timber harvest practices which gave the "Woodhawk" allotment its name.

The flora has a predominantly Great Plains biogeographic affinity consistent with the setting, especially in grassland communities. The forest and woodland types have an admixture of Rocky Mountain and eastern deciduous flora as found on nearby island ranges for the former and escarpment settings across most of the Great Plains for the latter. The riparian and wetland floras have many species which are widespread across the continent. The sparsely-vegetated badlands slopes have a relatively high component of Great Basin elements. The habitats with the highest concentrations of exotic species, apart from abandoned fields and other settings disturbed by man, are successional settings on the Missouri River and on badlands slopes.

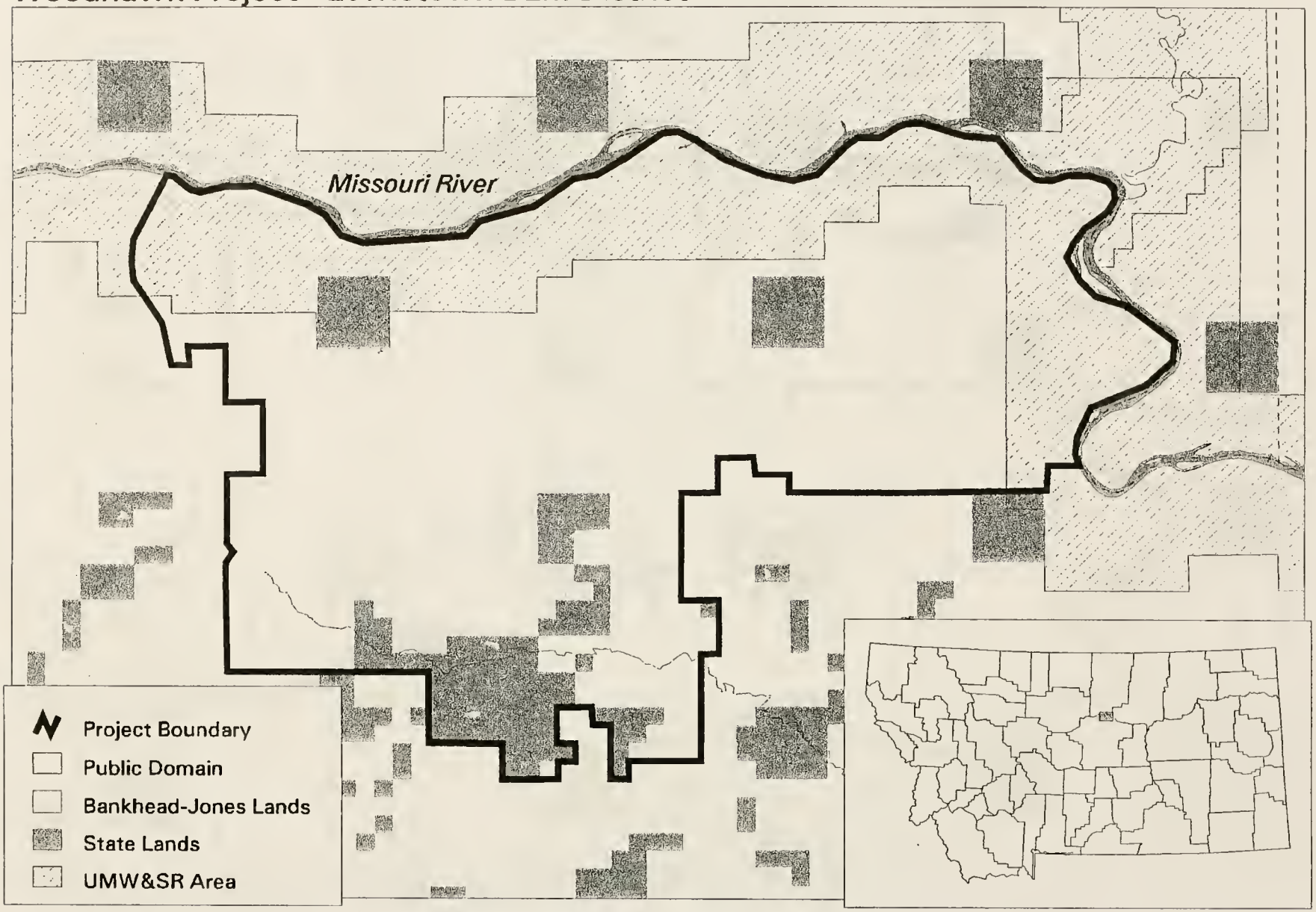
METHODS

The study methods which follow are presented at two levels: 1) Methodology for this intensive botanical survey, and 2) Methodology as might be applied in conducting routine BLM project plans. The basic difference between the intensive study and the routine project clearance review is that the former strives for plant biodiversity comprehensiveness, while the latter is focused on a discrete set of targets.

The Biological Conservation Database (BCD) was searched for all records of BLM special status features. The scope of the search was set to include the northern half of Fergus County, and adjoining counties, essentially signifying a 20 mile radius beyond the study area, with 30 mile extensions along the River. The focus was on BLM special status species and communities (USDI BLM 1996), also documenting any other state plant species of special concern (Heidel 1996) and state significant plant communities (Cooper and DeVelice 1995).

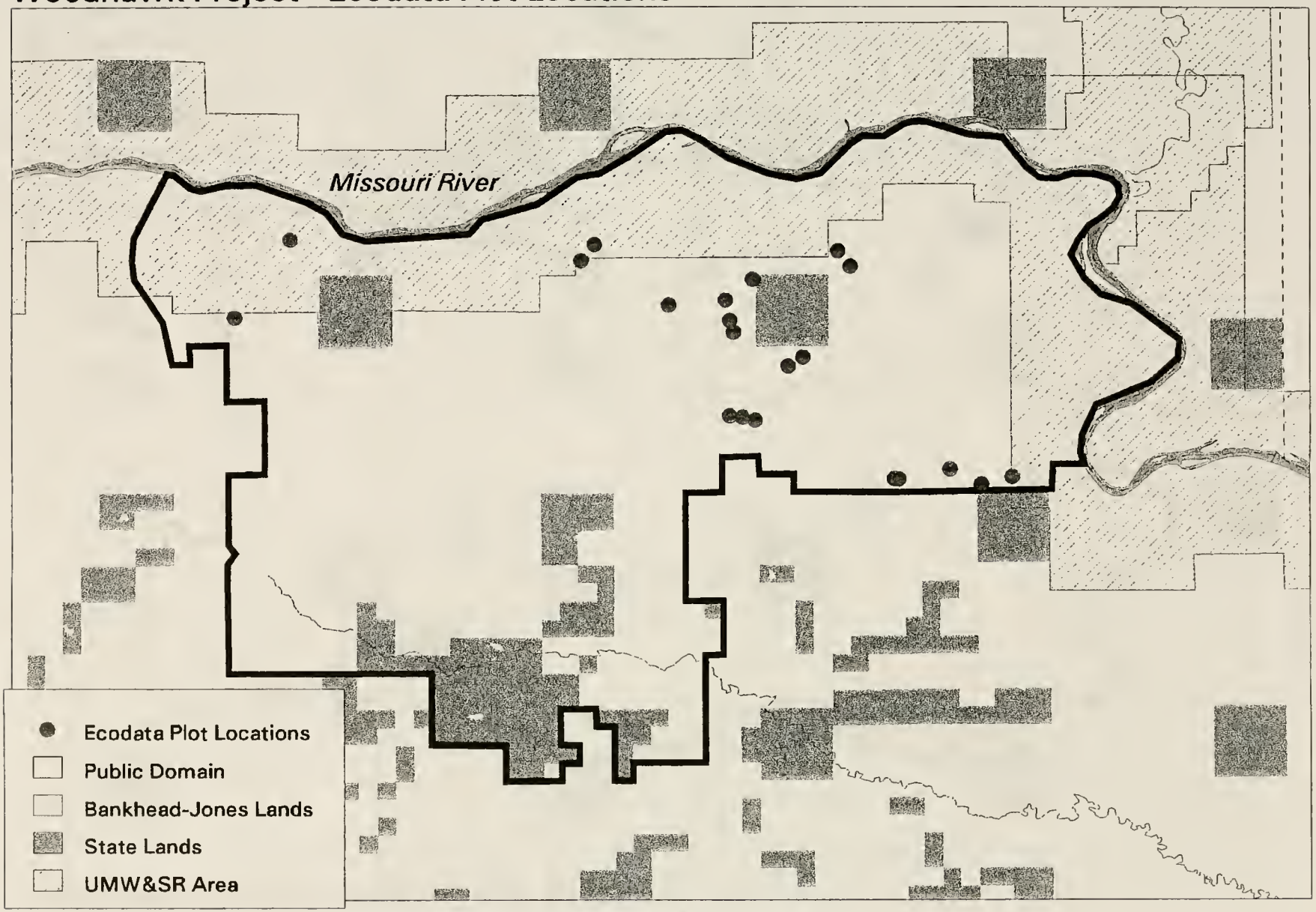
Element Occurrence Records for five BLM watch species were produced, though none were documented from the study area. The habitats and phenology of these five species formed the basis for setting primary search targets and identifying critical fieldwork timing. The scheduling of fieldwork was set to coincide with flowering phenology when the primary targets are visible and verifiable. The highest priority species helped determine the scheduling. The persistentsepal yellowcress (*Rorippa calycina*) is most easily spotted when in flower (late May-June) but cannot be reliably identified until fruits have formed in June. As a riparian species, it also required advance planning for the requisite river travel. Other sensitive species fieldwork focused on the habitat targets of the four other rare species in the area, including searching sandy range sites for little indian breadroot (*Psoralea esculenta*), and searching

Woodhawk Project - Lewistown BLM District



Montana Natural Heritage Program, February 20, 1997

Woodhawk Project - Ecodata Plot Locations



Montana Natural Heritage Program, February 20, 1997

wetlands or river shores for roundleaf water-hyssop, hot spring phacelia and slender-branch popcorn-flower *(Bacopa rotundifolia, Phacelia thermalis*, and *Plagiobothrys leptocladus)*, respectively. These five BLM watch species targets are listed on the following table. Habitat targets were set using the Fergus County soil survey (USDA Soil Conservation Service 1979) and its aerial photography, USGS topographic maps (7.5'), and firsthand information provided by BLM staff. Fieldwork was moved back to start in the latter half of June due to the late growing season conditions of 1996 and early June floodwater conditions that inundated potential habitat for persistentsepal yellowcress. Fieldwork was conducted June 17-20 and June 23-27. All river fieldwork was conducted on June 25 by BLM boat. Fieldwork routes as travelled on foot are marked on the maps in Appendix A.

For each sensitive species encountered, a Species of Special Concern survey form was filled out, accompanied by photographic documentation, and a voucher specimen when collecting did not significantly impact the population (Montana Native Plant Society 1993). All voucher specimens will be deposited at the University of Montana (MONTU), with duplicate material deposited in Montana State University (MONT).

SENSITIVE SPECIES TARGETS

Scientific name	**Common Name**	**Global and State Ranks**[1]
Bacopa rotundifolia	roundleaf water-hyssop	G5 S1
Phacelia thermalis	hot spring phacelia	G3G4 S1
Plagiobothyrys leptocladus	slender-branch popcorn-flower	G4 S1
Psoralea hypogaea	little indian breadroot	G4? S1
Rorippa calycina	persistentsepal yellowcress	G3 S1

The sensitive species survey steps can be summarized as follow:

- Check for sensitive plant records in and around the project area
- Set species search targets and timeframes for fieldwork
- Survey appropriate habitat at the appropriate times of the growing season
- Collect information on any sensitive plant populations, also documenting them photographs and specimens

These steps are much the same for both intensive botanical survey and for project clearance review. The

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[1]G1 S1 Critically imperilled
G2 S2 Imperiled
G3 S3 Vulnerable
G4 S4 Potentially secure
G5 S5 Secure

difference is that the intensive botanical survey spans the full range of habitats present in the study area and not just the narrow set of targets. It also involves compilation of a preliminary flora for the study area in order to take into consideration all possible species of special concern, including any new additions to the state flora. While neither the floristic nor the habitat scope of intensive survey can be exhaustive in only a fragment of one growing season, they provide a sensitive species baseline.

The sensitive community fieldwork was conducted in similar fashion. The BCD has few records of sensitive communities at present. The large body of statewide vegetation sampling data is in the process of being compiled into a single vegetation sampling database. Targets were identified from the literature as prioritized in a vegetation classification for the western United States (Bourgeron & Engelking 1995), as has been incorporated in the preliminary set of BLM special status community types (USDI Bureau of Land Management 1996) for community types known or suspected to be in the area. This drew heavily from literature compilations in DeVelice et al. (1995), and more recently sorted as BLM targets (Cooper and DeVelice 1995). Five special status plant communities were identified as prospective search targets. based on preliminary distribution information. The plant community targets are listed on the following page.

SPECIAL STATUS PLANT COMMUNITY TARGETS

Plant Community	**BLM Status**	**Global and State Rank**
Agropyron smithii	Watch	G3G5 S4
Andropogon scoparius - Carex heliophila	-	G3 S3
Artemisia longifolia/Oryzopsis hymenoides	Watch	G2 S2
Calamovilfa longifolia- Carex heliophila	-	G3 S3
Pinus ponderosa/Juniperus horizontalis	-	G3 S3

The timing of ecology fieldwork was not as crucial as that for sensitive species, although it is beneficial to wait until definitive determinations can be made for all dominants and abundant species. This is not until at least mid June for woodland understory species and wetland species.

Terrestrial vegetation and site characteristics information were collected for 23 plots according to methodology described in Cooper et al. (1995). The plots were located to sample both widespread and uncommon plant communities and to represent the spectrum of elevation, aspect, and lithologies across the study area (Figure 2). Sampling was conducted in circular plots (0.1 hectare; 11.3 m radius) taken to represent well-developed homogeneous composition and structure under natural conditions. The methodology is compatible with statewide vegetation data collected by Montana Natural Heritage Program, regionwide data collected by the U.S. Forest Service, western United States vegetation data collected by other state natural heritage programs, and with select BLM efforts. Riparian and wetland vegetation did not fit this sampling scheme because they occurred in linear bands. Many of these types were monodominant with few associated species, so quickplot description was made for recurrent types. Soil surface and soil texture class were noted in the course of vegetation sampling fieldwork.

Data were analyzed using the STRATA program, ECADS, (Ecological Classification And Description System), a USDA Forest Service ecological sampling package (Cooper et al. 1995). Plots were subjectively placed in 16 strata based on plant community type to produce plant species constancy and cover tables (Appendix B). The tables use six-letter acronyms to designate plant species by their scientific name. These are from the first three letter of the genus name followed by the first three letters of the specific epithet (USDA Forest Service 1996 update).

The vegetation work, as with the floristic work, covered the range of elevation, topography, and all major substrates in the study area. It would ideally cover all townships and map quadrangles, including most major pastures or sectors of BLM land in the area. Plant community fieldwork is typically focused on select community types which are the most rare or the best examples. It was expanded in this study mainly because the majority of community types were poorly documented. In conducting vegetation sampling within the various community types, priority was placed on sampling stands in good to excellent ecological condition (excellent range condition).

The preliminary floristic list that was built during and en route to the sensitive plant and plant community fieldwork is presented in Appendix D. Species which were collected are bold-faced on the list. Collections were made of sensitive species as vouchers, and to document possible range extensions, to document community dominants whose identification might warrant vouchers, and to work out identification questions which weren't resolved in the field. Non-native species are indicated as such on the floristic list by an asterisk. Systematic documentation of the flora would require more extensive collecting, revisits at earlier and later times of the growing season, and visits made over the course of more than one year.

Throughout this report, the scientific plant names are consisitent with Dorn (1984), with a few exceptions. To accomodate use with conventional range management references, older taxonomic treatments as presented in Hitchcock and Cronquist (1973) are followed for the wheat and rye grass (the general *Agropyron* and *Elymus*). In Dorn (1984) these are lumped, except for crested wheatgrass, under the genus *Elymus*. Other more recent treatments split them into *Leymus, Pseudoroegneria, Elytrigia,* and *Pascopyrum*. Synonymy is given, as appropriate, to promote familiarity with the newer names. Synonyms (abbreviated syn.) are also given in the text for species whose nomenclature in the constance/cover tables of Appendix B. differs from Dorn (1984). This reference does not cover infraspecific taxa, but the subspecies of, e.g. big sagebrush (*Artemisia tridentata*) are important ecological indicators used in statewide vegetation classification (Cooper et al. 1995). Taxonomic keys to these subspecies may be found in Beetle (1982) and in Dorn (1992).

There may not be a counterpart system in place which serves the purpose of reviewing special status communities for BLM project reviews. If the target list of sensitive community types is treated as an augmentation of range site information, then it can be made part of routine range analysis. The theory and practice behind the vegetation classification and prioritization work is described in the following section, before presenting results.

Vegetation classification perspective

Vegetation classification, long regarded as something of an academic exercise, has come to the forefront as a powerful natural resources management tool. Its utility is predicated on the argument that plant species composition and structure is the most complete integrator of biotic and site (abiotic) conditions and reflects the history of land use as well. More recently, vegetation has been employed as a framework for conservation planning among federal, state, and private organizations. The Nature Conservancy employs communities of native plants as the "coarse filter" for identifying and protecting common species and landscape ecosystems, and rare species as the "fine filter" (Noss 1987).

Vegetation units provide a basis for setting biodiversity conservation priorities, based on rangewide and statewide status. Criteria used include current and historic extent, uniqueness, existing protection and threats. This focus does not preclude, but rather complements the treatment of vegetation for its management values. To enhance its utility in both regards, background information on vegetation classification is summarized in this methods section with the goal of placing results of the inventory in a more fully developed ecological context.

In this report , beginning on pg. 15, we describe 20 vegetation or synecological units. Synecology is the field of ecology that deals with systems of many species, whole communities or major fractions of communities. The kinds of vegetation units recognized are abstract classes, each class being an assemblage of concrete examples, usually represented by samples or plots, and based on some characteristics they hold in common. Communities can be classified based on different kinds of characteristics, such as growth-form dominance, structure by strata, species composition or dominance based on an abstract grouping of samples "stands."

There are at least 20 schools of synecology (Shimwell 1971) based on different sets of classfication criteria and the accompanying concepts of and terminology for vegetation "organization." In the Inland Northwest and Northern Rocky Mountains, R. Daubenmire originated and applied a widely-used structured hierarchical classification system. The next several paragraphs will explain concepts of this classification because so many of the classifications developed throughout the west are the intellectual lineal descendants of those developed by Daubenmire (e.g. Daubenmire 1970 and Daubenmire and Daubenmire 1968).

Daubenmire is best known for his "habitat type" concept; a habitat type (h.t.) being all those land areas potentially capable of supporting similar plant communities at climax or some long-term stable state. Although this "climax" state is theoretical and seldom develops because of recurring disturbance, the trend toward climax can be identified in the field from an examination of stand age class structure (at least for forest and woodland formations). The climax plant community is the most meaningful index of the environmental factors affecting vegetation because it is the relatively stable concluding stage of plant succession and in dynamic equilibrium with macroclimate. A habitat type represents a discrete segment of the environmental spectrum. Thus the habitat type system has been treated as a land classification system centered around the potential plant community as an integrated bioassay of environmental factors as they affect species reproduction and competitive effects (Pfister and Arno1980, Steele et al. 1981) . Others (Hall 1980, Mueller-Dombois 1964) specify that to function as a management-oriented

site or land classification system, habitat types should be more narrowly defined. These authors include landscape features, productivity, and other management-oriented variables in defining taxonomic units (habitat type or plant association).

Habitat types are conveniently named for the potential climax community type, termed plant association (Daubenmire and Daubenmire 1968). For example, *Abies lasiocarpa/Xerophyllum tenax* is the plant association potentially dominated in the tree layer by *A. lasiocarpa* (subalpine fir) and having an undergrowth in which *X. tenax* (beargrass) is diagnostic. In the classification hierarchy, the series (or alliance, TNC) level is denoted by the first Latin binomial; in forest and woodland types this is usually the most shade-tolerant tree adapted to the site. The species may be represented by little cover, but from successional studies and knowing its ecology we can project it to be an important component, the climax dominant. In the simplified ecology of western forests virtual single-species dominance is often the end-point of succession. For shrub- and forb-dominated types the strategy is basically the same but projecting population structure is more problematical. The second part of the type name is that of another indicator species (that may also be a dominant species as well), usually of a lesser lifeform; it is this second portion of the name that confers a higher degree of specificity and designates the association level. Indicators are chosen for their fidelity to a certain portion of the environmental spectrum and usually highly constant occurrence. Occasionally a type will be identified (in keys to types) by multiple and approximately equivalent indicator species, but be named for only one of the suite of indicator species. The presence of a third species name may indicate a phase (and be so noted), usually a minor floristic variation, difference in vegetation dominance in a third layer, or broad transition between two allied habitat types, or it may simply be incorporated into the plant association name as a further descriptor or name serving to distinguish between similar types.

It should be noted that Daubenmire's concept of plant association differs from that recognized by the International Botanical Congress in that it refers only to late-seral or climax conditions rather than existing vegetation. An association is comprised of all climax stands in which the dominants of corresponding layers are essentially the same, to the extent that any differences in composition are due to chance dissemination or to a transitory historic factor, rather than to a fundamental dissimilarity in habitat potentialities. The plant association is a subjective concept based on those characters at least potentially common to all the separate stands which represent it, and which serve to distinguish the grouping from all other stands. It is abstract in that not all stands comprising it can be studied and we therefore assume that the range and mean characteristics of the inventoried stands represent the entire group. Note that no two stands grouped into one association are ever identical and that soil, macro- and microclimate, and the zoological component may differ from stand to stand, but that their sums produce vegetation groupings with a high degree of similarity.

A problem in classification is posed by all vegetation stages preceding the climax condition. The vast majority of land area included in any one h.t. is recovering from disturbance and thus occupied by seral plant communities which vary due to floristic and recruiting accident (stochastic element), as well as stages of development. In forest/woodland vegetation, where the course of succession is protracted, it is possible to define intermediary and relatively homogeneous stages called "associes" or more commonly known as community types. "Community type" refers to seral vegetation stages or when the seral status of a stand or assemblage of like stands is in question.

There can be a many seral community types resulting from the disturbance of a single plant association. The great strength of classifications reflecting Daubenmire's approach is that they emphasize the fact that intrinsic characteristics of soil and macroclimate remain essentially unaltered during the successive cycles of destruction and regeneration of climaxes. If one accords temporary and climax communities equal weight, then one cannot establish with any degree of precision the relationship between communities and climate and soils. It follows therefore that immature units are most effectively related in classifications to the mature forms they represent. A telling advantage of centering classification on the most stable types that can be found is that it aggregates different successional communities represented by a virtually infinite variety of subtly intergrading stages that all lead to a highly reduced number of stable types. This results in a far more simplified classification than would be the product if all temporal variants of vegetation are treated as equally significant. This is not to say that tracking seral variants is not important, but it expands the scope of work .

Three common misconceptions arising from the use of plant association names, *sensu* Daubenmire, are that: (1) an abundance of climax vegetation is present in the current landscape, (2) we should manage the resource to promote climax vegetation, (3) to apply this classification system requires climax vegetation. The opposite is true in the first two instances: (1) a very high percentage of our forested landscape and a high, but unknown portion of non-forest land reflects some degree of disturbance, resulting in a preponderance of seral stages, (2) in forests and some shrub-dominated environments, management strategies usually favor seral species, regardless of the plant association. In grasslands, conversely, usually the late-seral/climax species are favored. In the third instance, the misconception is too narrow and we can in fact compare the relative reproductive success of the tree species present with known successional patterns and scrutinize the current undergrowth vegetation to identify the plant association (i.e. habitat type). Where stands have been severely disturbed, are in early seral stages, or at the closed-canopy stage (having depauperate undergrowth vegetation) comparison of the stand with adjacent stands of later seral stages having comparable site factors permits identification of the potential climax vegetation.

Daubenmire and other western vegetation ecologists, who have developed classifications for various geographic and geopolitical entities, have paid scant attention to defining the higher level strata of what is a hierarchical system. However the Nature Conservancy hierarchical classification system, derived a modification of the UNESCO system Driscoll et al. 1973), is well-developed and represents a potential national vegetation classification. Currently it is being reviewed by a committee of the Vegetation Ecology Section of the Ecological Society of America. The floristically-defined vegetation units we have employed fit into the next higher levels (Formation and Group, essentially defined by physiognomic characteristics) of the Nature Conservancy classification.

The current Nature Conservancy hierarchical vegetation classification does not superscede that of Daubenmire but provides an overarching hierarchy, aw well as recognition of recurrent seral assemblages, or **community types** (c.t.). in addition to the climax **plant associations** (p.a.) as presented for Montana in "A preliminary vegetation classification of the western United States" (Bourgeron and Engelking 1994).

The following sketches of study area plant associations and community types are arranged by decreasing stature of lifeform and alphabetically within lifeform; the barrens and wetland types are broken out separately due to the uniqueness of their environments. Description is provided of the accompanying environment, soils, and vegetation.

Within the vegetation section, in addition to giving a quick characterization of composition, a comparison between the study area occurrence of the type and other representations of the type throughout the state and western U. S. is made. The constancy-cover tables are useful for comparing the expression of community types on the study area to the named type as it occurs elsewhere. Local expressions in composition are readily appreciated in these comparisons. Two reports that present a preliminary regional synthesis of plant associations/communities across all lifeforms and environments and have dichotomous keys useful for identifying the vegetation types are "Plant communities of northeastern Montana: A first approximation" (DeVelice 1995) and "Classification of southwestern Montana plant communities: Emphasizing those of Dillon Resource Area, Bureau of Land Management" (Cooper et al. 1995). These publications can be consulted as conceptual models and technical references to the various vegetation units on the study area landscape.

RESULTS AND DISCUSSION

Only one BLM watch species was documented in the study area, little indian breadroot (*Psoralea hypogaea*), from two locations (Appendix B). In contrast over 40% of the plant community types in the area are potentially rare or at least under-documented in statewide vegetation sampling (10 of 20). Thus, priority was placed on ecological inventory.

In the following discussion, ecological results are discussed first, followed by sensitive species results. Both sets of results are systematic and thorough, but are not comprehensive. They do not take the place of on-site evaluations within the study area, or provide the power of prediction outside of it.

Ecological Results

Biological significance of plant association is tempered first by the rarity of the type (geographic extent relative to rangewide or statewide scales) and secondly by the relative qualities of the stand (quality and condition). By the rarity standards, coupled with the results of this study, the most significant plant associations are:

<u>High global priorities</u>
Pseudotsuga menzeisii/Oryzopsis micrantha (G2 S2)
Pinus ponderosa/Carex heliophila (G3 S3)
Rhus trilobata/Andropogon scoparius (G3 S3)

<u>High state priorities</u>
Juniper scopulorum/Oryzopsis micrantha (G4 S3)

<u>Possibly high state or global priority</u>
Populus deltoides/Symphoricarpos occidentalis
Puccinellia nuttalliana
Scirpus americanus

This is summarized in saying that there are potentially one globally imperiled, two globally vulnerable, one state vulnerable, and three plant associations of undetermined status in the Woodhawk study area. The globally vulnerable plant association, *Pinus ponderosa/Carex heliophila,* is also recognized on the watch list as a special status plant association of the Bureau of Land Management. Two types that were originally ranked as vulnerable in Montana have been reranked as potentially secure based on this study. The plant community types and supporting plot data numbers are presented in Table 3. None of the above plant associations are extensive examples or excellent examples. The first two are perhaps largest in total area. The prevailing vegetation types are in fair to good ecological conditions. What is most significant about the study area is the juxtaposition of the forest, grassland, shrubland, and wetland types in a single plains area. The intactness of this landscape is diminished by historic logging and floodplain farming, past and present livestock use in the lowlands, downcutting due to water impoundments, and noxious weed encroachment which is still at early stages of invasion.

PLANT ASSOCIATIONS OF THE WOODHAWK STUDY AREA

COMMUNITY STRUCTURE	PLANT ASSOCIATION	CURRENT RANK	RECOMMEND - ED RANK	PLOT NO.
Forest	*Pseudotsuga menziesii/Oryzopsis micrantha p.a.*	G2 S2	G2 S2 BLM Watch	001, 004, 009, 013, 015
Woodland	*Pinus ponderosa/Carex heliophila p.a.*	G3 S3; also BLM Watch	G3 S3 BLM Watch	101, 017, 019
	Pseudotsuga menziesii/Juniperus scopulorum p.a.	G4 S4	G4 S4	003, 005
	Populus deltoides/Symphoricarpos occidentalis c.t.	G2G3 SU	G4 SU	-
(Woodland)	*Juniperus scopulorum/Oryzopsis micrantha p.a.*	G4 S3	G4 S3	020
Shrubland	*Artemisia cana/Agropyron smithii p.a.*	G4 S4	G4 S4	008
	Artemisia tridentata ssp. vaseyana/Agropyron smithii p.a.	G3 SU	G4 S4	002, 014, 021
	Artemisia tridentata ssp. vaseyana/Agropyron spicatum c.t.	G5 S5	G5 S5	018
	Rhus trilobata/Andropogon scoparius p.a.	G3 S3	G3 S3	-
Barrens	*Artemisia longifolia p.a.*	G3 S3	G4 S4	016
	Sarcobatus vermiculatus/Agropyron smithii p.a.	G4 S4	G4 S5	-
Grassland	*Agropyron spicatum- Poa secunda c.t.*	G5 S5	G5 S5	006
	Bouteloua gracilis-Carex filifolia p.a.	G4 S4	G4 S4	007, 012
	Stipa comata - Agropyron smithii p.a.	G5 S5	G5 S5	011

COMMUNITY STRUCTURE	PLANT ASSOCIATION	CURRENT RANK	RECOMMEND - ED RANK	PLOT NO
Wetland	*Agropyron smithii p.a.*	G5 S5	G5 S5	-
	Eleocharis palustris p.a.	G5 S5	G5 S5	-
	Juncus balticus p.a.	G5 S5	G5 S5	-
	Puccinnellia nuttalliana p.a.	G1 S-	GU SU	-
	Scirpus americanus p.a.	G1Q S-	GU SU	-
	Scirpus maritimus p.a.	G4 S4	G4 S4	-

Ranking definitions
G1 S1 Critically imperilled
G2 S2 Imperiled
G3 S3 Vulnerable
G4 S4 Potentially secure
G5 S5 Secure
GU SU Recognized but undetermined

The following terrestrial communities are based on descriptions in DeVelice et al. (1995), and the wetland communities are based on Hansen et al. (1995) unless otherwise indicated. The description information in this study is used to expand and refine the community descriptions and accompanying ranks, and is also used to update the Judith Resource Area information presented in the previous statewide catalogue of communities by BLM resource area (Cooper and DeVelice 1995). The vegetation sampling data results are presented in Appendix C, including cover synthesis and constancy tables. Community type photos are presented in Appendix E.

Vegetation Descriptions: FOREST AND WOODLAND TYPES

Pseudotsuga menziesii/Oryzopsis micrantha p.a. (G2 S2)
(PSEMEN/ORYMIC; Douglas-fir/little ricegrass; 5 plots)

Environment: PSEMEN-JUNSCO/ORYMIC is a restricted forest type in the most mesic upland sites as found in steep-sided drainage courses and on north-facing valley slopes above the Missouri River and Woodhawk Creek. Some of the best-developed examples are at the heads of draws and on sheltered midslope benches.

Soils: This type is among the few tree-dominated types in the study area with high litter (30-80%) and moss cover rather than bare ground at the surface. It occurs on silt loam associated with the Dilts-Julin-Rock outcrop complex (USDA Soil Conservation Service 1979), as are all of the study area conifer types. These are noteably acidic compared with other soils in the study area; the Dilts series is acidic and the Julin series is strongly acidic.

Vegetation: PSEMEN/ORYMIC is the only forest association in the study area, with terrestrial vegetation canopy approaching or exceeding 100%. The Douglas-fir canopy cover alone ranges from 40-60%. Rocky Mountain juniper (*Juniperus scopulorum*) makes up a broken understory of 20-30% cover (for a discussion of the problems in classifying Rocky Mountain juniper in the Missouri Breaks, see the description of the Rocky Mountain juniper/little ricegrass plant association). The low shrub cover component is highly variable depending on slope, aspect and topographic position and often includes a short shrub layer dominated by snowberry (*Symphoricarpos* spp.; 0-30% cover). It is provisionally recognized as common snowberry (*Symphoricarpos albus)* based on the thin leaves and hollow stem, but flowering or fruiting material was not available, and all three species are reported from Fergus County (Booth 1966). The two species, common snowberry and western snowberry (*Symphoricarpos occidentalis*) are lumped under the latter name in the other vegetation studies that were conducted in this habitat (Roberts and Sibbernson 1979). The Douglas-fir stands sampled elsewhere on BLM lands in the District had an understory of *Symphoricarpos occidentalis* (DeVelice et al. 1995), but they adjoined the Little Rocky Mountains and were not from the Missouri Breaks. The cover of little ricegrass (*Oryzopsis micrantha*) ranges from 10-20% cover; with the lower values in the younger stands.

This plant association has the best developed woodland flora in the study area, including the highest number of shade-tolerant species like Pennsylvania pellitory (*Parietaria pensylvanica)* which sometimes has significant cover (up to 20%). Other commonly associated species include small-flowered blue-eyed Mary (*Collinsia parviflora)* and yarrow (*Achillea millefolium).* It is believed to correspond to the association described in the Little Rocky Mountains by Roberts (1980) as having an understory of plains muhly (*Muhlenbergia cuspidata)* along with a "remarkably luxuriant undergrowth" and a "carpet of moss". This grass is not known to grow in woodland associations, and may have been misidentification of *Oryzopsis micrantha.*

Logging was commonplace throughout this landscape, but access may have been limiting in places. A couple stands were found with trees that were equal or greater than 0.8 m DBH.

This association may be a melding of recognized Rocky Mountain and Great Plains plant communities where their ranges overlap (PSEMEN/SYMALB and JUNSCO/ORYMIC), or it may be a relict community. It is intermediate between the two related communities, floristically and structurally, but has a relatively diverse flora which includes species in different environments than in the center of their range, and species that are not present in other local communities. The lichen, *Cladina stellaris*, was observed on the ground in old, well-developed stands of this association. It is a boreal species of lichen which has not previously been reported in the state flora according to McCune and Goward (1995). This lichen species should be collected and verified. The possibility that these communities are relict communities warrants further investigation.

The merging of vegetation information from the Little Rocky Mountains and the Missouri Breaks is necessary but not sufficient for changing the global and state ranks from imperiled (S2) to vulnerable (S3) in the state. This plant association remains among the rarest of known plant associations that are present in the study area, and the study area includes a limited number of stands in excellent condition and development. Little indian ricegrass is a decreaser (Smith 1976) and many of these stands are accessible and favored by livestock, so this plant association is recommended for BLM consideration as watch.

***Pinus ponderosa/Carex heliophila* p.a. (G3 S3)**
(PINPON/CARHEL; Ponderosa pine/sun sedge; 3 plots)

Environment: PINPON/CARHEL is a widely scattered open woodland, or "savanna" type, in bands and stringers associated with shale barrens. It is found in upper topographic positions along drainageways, and is particularly well-developed along north-south trending ridges above Woodhawk Creek side tributaries. It occurs on all but north aspects. Surface cover depends on the erodability of the habitat, primarily determined by slope and topographic position. Exposed shale is at the surface, but bare soil is usually less extensive than the litter cover (40-60%) associated with sun sedge (*Carex heliophila*), at least in undisturbed habitat on gentle slopes. Lichen cover also helps stabilize the shale

slopes. Erosion causes both burial and undercutting in this habitat. This environment is believed to correspond with the "acid shale pine forest" on Bear Paw shale as described by Lesica (1987) on the War Horse Lake Area of Critical Environmental Concern.

Soils: In the study area, it occurs on the Dilts Series of the Dilts-Julin-Rock outcrop complex, which has strongly acidic A1, C1 and C2 horizons (USDA Soil Conservation Service 1979). The War Horse Lake ACEC was said to have soil pH values of 3-4 (Lesica 1987), but pH values for the study area were not available. The other major descriptions of this type in the state link it to coarse parent material other than shale (Hansen and Hoffman 1988, DeVelice et al. 1995).

Vegetation: PINPON/CARHEL p.a. has a savanna structure of open-grown pine (10-30% cover) with a major prairie and pioneer species component. Rocky Mountain juniper is usually present in low density, contributinges 1-5% cover. The associated forb species all overlap with the flora of the long-leaved sagewort (*Artemisia longifolia*) association as found in seral settings, including: golden pea (*Thermopsis rhomifolia),* American vetch *(Vicia americana),* narrow-leaf collomia *(Collomia linearis),* shining penstemon *(Penstemon nitidus)* and threadleaf phacelia *(Phacelia linearis*). Sun sedge (*Carex heliophila*) makes up app. 10-20% of the cover, and it expands and survives the forces of erosion by vegetatively reproducing via rootstocks, forming dense patches or extremely sparse isolated clusters. Note: Sun sedge keys out in the state flora (Dorn 1984) as *Carex pensylvanica*, and is recognized in other taxonomic references under the name of *C. inops*. The species association closely corresponds with that of the War Horse Lake ACEC as described in Lesica (1987), except in the apparent absence of creeping juniper (*Juniperus horizontalis*) from the study area (see discussion of this under the Rocky Mountain juniper/little ricegrass p.a.).

Recognition of this plant association as a significant biodiversity feature has been formalized in designating the War Horse Lake Area of Critical Environmental Concern (ACEC), where there is the largest and best representation of this feature known in Montana. The new designation of War Horse Lake ACEC and the information from this study are necessary but not sufficient basis for changing the state and global ranks of this plant association to potentially secure (G4 S4), contingent on the documentation of healthy stands elsewhere along the Missouri River.

PSEMEN/JUNSCO; Douglas-fir/Rocky Mountain juniper; 2G4 S4)

(Pseudotsuga menziesii/Juniperus scopulorum p.a.; 2 plots)

Environment: PSEMEN/JUNSCO is the most extensive woodland type in the study area, filling the interstices between the other upland forest and savanna types, and intergrading with nearly all upland types. It is most continuous along valley slopes except where interrupted by drier steppe and barrens.

Fire scars were not observed, even though it occupies a fire-prone habitat. Many of the trees were less than 20 cm DBH, a size class that may reflect the slowness of establishment and growth since the

western snowberrry, and persistence of native herbaceous species. These settings are extremely vulnerable to invasion by exotics, and the mesic riverbottom habitats have been largely taken over by smooth brome (*Bromus inermis*) and quackgrass (*Agropyron repens*; syn. *Elymus repens*). Noxious weed invasion is an ongoing threat in this and adjoining habitat, including Russian knapweed (*Centaurea repens*; syn. *Acroptilon repens*) and leafy spurge (*Euphorbia esula*). The former is rapidly expanding on cottonwood habitat of open islands. Salt-cedar (*Tamarix* spp.) is notably absent.

This type had not been documented in the state before the work of Hansen et al. (1995). While they consider it as a grazing disclimax of the plains cottonwood/red-soier dogwood community (*Popululus deltoides/Cornus stolonifera),* it is recommended for reconsideration as substrate-specific community type under natural conditions. For this reason, its recommended state rank is status undetermined (SU) pending further review.

***Juniperus scopulorum/Oryzopsis micrantha* p.a. (G4 S3)**

(JUNSCO/ORYMIC; Rocky Mountain juniper/littleseed ricegrass p.a.; 1 plot)

Environment: JUNSCO/ORYMIC is a highly-restricted community on north-facing slopes, only found in one stand in the study area. The setting has a northnortheast aspect, and the stand is restricted to the upper slope position where it is extremely exposed to wind.

Soils: The silty soils are members of the Dilts-Julin-Rock outcrop complex, are not visible at the surface, and are covered by a dense moss layer (70%) with scattered overlying litter (20%).

Vegetation: JUNSCO/ORYMIC has a dense, continuous canopy (80% cover) with interconnected crowns. While Rocky Mountain juniper is considered a tree and commonly has an upright, single-trunk growth form, this plant association has a canopy height less than 3 m. and it is made up of gnarled plants without a central terminal axis. It was speculated in the previous vegetation work of Roberts and Sibberman (1979) that creeping juniper (*Juniperus horizontalis)* and Rocky Mountain juaniper (*J. scopulorum)* may hybridize in the Missouri River Breaks, which might account for plants with non-apiculate leaves and upright shrub stature consistently less than 3 m high. The authors of this previous study treated this taxa in their forest vegetation study as an undergrowth shrub rather than as a tree. This same plant association has been well-documented downstream in North Dakota (Jensen et al. 1992) where it is considered to be a woodland type. We provisionally treat it as a woodland type.

The relative paucity of old Rocky Mountain junipers in the study area is more likely due to logging for fence posts rather than the ubiquity of fires, and the few old persisting trunks that were found had been cut. They included individuals greater than 6" DBH while most live trees were smaller than 6" DBH. It was noted that both glabrous and glaucous forms of Rocky Mountain juniper were present as distinct morphs.

western snowberrry, and persistence of native herbaceous species. These settings are extremely vulnerable to invasion by exotics, and the mesic riverbottom habitats have been largely taken over by smooth brome (*Bromus inermis*) and quackgrass (*Agropyron repens*; syn. *Elymus repens*). Noxious weed invasion is an ongoing threat in this and adjoining habitat, including Russian knapweed (*Centaurea repens*; syn. *Acroptilon repens*) and leafy spurge (*Euphorbia esula*). The former is rapidly expanding on cottonwood habitat of open islands.

This type had not been documented in the state before the work of Hansen et al. (1995). While they consider it as a grazing disclimax of the plains cottonwood/red-soier dogwood community (*Popululus deltoides/Cornus stolonifera),* it is recommended for reconsideration as substrate-specific community type under natural conditions. For this reason, its recommended state rank is status undetermined (SU) pending further review.

Juniperus scopulorum/Oryzopsis micrantha p.a. (G4 S3)

(JUNSCO/ORYMIC; Rocky Mountain juniper/littleseed ricegrass p.a.; 1 plot)

Environment: JUNSCO/ORYMIC is a highly-restricted community on north-facing slopes, only found in one stand in the study area. The setting has a northnortheast aspect, and the stand is restricted to the upper slope position where it is extremely exposed to wind.

Soils: The silty soils are members of the Dilts-Julin-Rock outcrop complex, are not visible at the surface, and are covered by a dense moss layer (70%) with scattered overlying litter (20%).

Vegetation: JUNSCO/ORYMIC has a dense, continuous canopy (80% cover) with interconnected crowns. While Rocky Mountain juniper is considered a tree and commonly has an upright, single-trunk growth form, this plant association has a canopy height less than 3 m. and it is made up of gnarled plants without a central terminal axis. It was speculated in the previous vegetation work of Roberts and Sibberman (1979) that creeping juniper (*Juniperus horizontalis)* and Rocky Mountain juaniper (*J. scopulorum)* may hybridize in the Missouri River Breaks, which might account for plants with non-apiculate leaves and upright shrub stature consistently less than 3 m high. The authors of this previous study treated this taxa in their forest vegetation study as an undergrowth shrub rather than as a tree. This same plant association has been well-documented downstream in North Dakota (Jensen et al. 1992) where it is considered to be a woodland type. We provisionally treat it as a woodland type.

The relative paucity of old Rocky Mountain junipers in the study area is more likely due to logging for fence posts rather than the ubiquity of fires, and the few old persisting trunks that were found had been cut. They included individuals greater than 6" DBH while most live trees were smaller than 6" DBH. It was noted that both glabrous and glaucous forms of Rocky Mountain juniper were present as distinct morphs.

The herbaceous understory composition overlapped with that of other woodland types, including trace cover of Pennsylvania pellitory (*Parietaria pennsylvanica*), goldenrod (*Solidago* spp.), textile onion (*Allium textile*), small-flowered blue-eyed Mary (*Collinsia parviflora*), and northern fairy candelabra (*Androsace septentrionalis).*

Vegetation Descriptions: SHRUBLAND TYPES

Artemisia cana/Agropyron smithii (G4 S4) p.a.

(ARTCAN/AGOSMI; silver sage/western wheatgrass; 1 plot)

Environment: ARTCAN/AGRSMI is a major type throughout the Woodhawk Creek bottoms and in parts of the floodplains of the Missouri River. Habitat in the former setting has been diminished and degraded by historical farming and grazing practices, but the latter is largely intact. At early-successional settings like toeslopes and on the stream terraces, green rabbitbrush (*Chrysothamnus viscidiflorus*) is common and may in fact represent a localized successional community.

Soils: Soils are alluvial, mapped as Havre and Harlem loams, occasionally flooded (USDA Soil Conservation Service 1979).

Vegetation: ARTCAN/AGRSMI is a robust steppe type compared with others in the study area (shrub height equal or greater than 1 m). It has a consistently high proportion of exotic species, including yellow sweetclover (*Melilotus officinalis),* gold-of-pleasure *(Camelina sativa)*, and flixweed (*Descurainia pinnata)*, reflecting the degraded condition.

Artemisia tridentata ssp. *vaseyana/Agropyron smithii* p.a. (G3 SU)

(ARTTSW/AGRSMI; Wyoming big sage/ western wheatgrass; 3 plots)

Environment: ARTTSW/AGRSMI is the prevailing vegetation type in the rolling unglaciated uplands of the study area. It represents the "breaks type" rangeland at the edge of the Missouri River breaks (Watts et al. 1987), which makes up the great majority of the primary range in the study area.

Soils: Soils are very-fine clay, moderately alkaline (calcareous), and montmorillonitic. This gives the it a fine granular structure which is very hard when dry, but very plastic and sticky when wet. Most soils are Thebo clay, 2-8% slope.

Vegetation: ARTTSW/AGRSMI is a northern shrubland association with remarkable compositional homogeneity across large areas. Cover of Wyoming big sage (*Artemisia tridentata* ssp. *vaseyana*) ranged between 20-30%, and cover of western wheatgrass (*Agroyron smithii*; syn. *Elymus smithii*) was between 10-20%. Dominance by western wheatgrass is consistently high throughout, but Sandberg's

bluegrass (*Poa secunda)* approaches co-dominance under grazing pressure. Invasive species like cheatgrass (*Bromus tectorum)* are scarce at present but are ubiquitous in trace amounts. Overall forb composition is similar throughout, but a few fobs differ in frequency between sites, including yarrow (*Achillea millefolium), textile onion (Allium textile),* bastard toadflax *(Commandra umbellata),* fennel-leaved desert-parsley *(Lomatium foeniculum),* and American vetch *(Vicia americana).*

ARTTSW/AGRSMI p.a. makes up most of the primary range in this allotment. It has historically and was currently being grazed season-long. The trends in vegetation and bare ground cover have been compared between season-long and rest-rotation grazing regimes within the Woodhawk Creek burn to determine that vegetation cover and trend are significantly higher with rest-rotation compared to season-long treatment (Watts et al. 1987). The effects of grazing vary between pastures and segments; sampled sites included a stands in fair to excellent conditions (Appendix E).

The potential plant community ascribed to the Thebo clay soil series is said to include western wheatgrass (*Agropyron smithii*; syn. *Elymus smithii*), green needlegrass (*Stipa viridula*), bluebunch wheatgrass (*Agropyron spicatum*; syn. *Elymus spicatus*, and thickspike wheatgrass (*Agropyron dasystachyum*; syn *Elymus lanceolatus*; Clark 1979), with no mention of sagebrush. This is inconsistent with study area observations, in which Wyoming big sage *(Artemisia tridentata* ssp. *vaseyana)* was ubiquitous. It is either a case of contradiction between range site and plant association classification, or the study area shrubland may be a localized phenomonon that is restricted to the breaklands vicinity.

Artemisia tridentata var. *vaseyana/Agropyron spicatum* c.t.

(A rank has not been assigned for the variety; all of the varieties together are G5 S5)
(ARTTSW/AGRSPI; Wyoming big sage/ bluebunch wheatgrass; one plot)

Environment: This is a well-developed type elsewhere in the state, but appears to be a minor seral type in the study area following fire as indicated by charred stumps. Apparently fire has killed overstory trees that have not regenerated as quickly as big sage. It was seen in a few, small areas on or near ridgetops over shale.

Vegetation: ARTTSW/AGRSPI directly overlaps in composition with PINPON/JUNSCO except for woody species and their canopy cover.

Rhus trilobata/ Andropogon scoparius p.a. (G3 S3)

(RHUTRI/ANDSCO; skunkbush sumac/ little bluestem; no plots)

Environment: RHUTRI/ANDSCO p.a. is restricted to exposed south-facing slopes of sandstone outcrop and sandy colluvium, as found on Reppe Butte. It is associated with sandstone of the Judith Formation capping some of the promatories in the study area.

Vegetation: Cover of both skunkbush sumac (Rhus trilobata syn. Rhus aromatica) and of little bluestem (Andropogon scoparius syn. Schizachyrium scoparium) is less than 10% each. There is a relatively high diversity of forbs, and this plant asosciation was among the habitats targeted for sensitive species survey. Common associated species include: yucca (Y*ucca glauca),* prairie sandreed *(Calamovilfa longifolia),* thread-leaved sedge *(Carex filifolia),* alpine bladderpod *(Lesquerella alpina)* and standing milkvetch (*Astragalus adsurgens).* It is likely to be more widespread in eastern Montana than documented in Forest Service studies (Hansen and Hoffman 1988). This study does not provide adequate grounds for changing its ranks.

Vegetation Descriptions: BARRENS

***Artemisa longifolia* p.a..** (G3 S3)
(ARTLON: Long-leaved sagewort; 1 plot)

Environment: ARTLON p.a. is a discrete shale barren type, occupying the most xeric of vegetated shale slopes. The platy shale substrate is very loose and friable. It spans the full range of slope positions betwen upper to lower slope, depending on the shale outcrop level, aspect, slope angle, and erosion forces. In some upper slope positions, it is situated above loose shale where the slope appears to be gradually eroding from under it.

Soils: The outcrop clays which make up the substrate are in the Nedore rock outcrop and possibly in the Dilts-Julin-rock outcrop complex complex, too.

Vegetation: Widely-spaced *Artemisia longifolia* shrubs have a cover of about 10% in this type, making up the majority of all cover. Pioneer and outcrop species are commonly present, including Douglas' knotweed *(Polygonum douglasii),* shining penstemon *(Penstemon nitidus),* lambsquarter *(Chenopodium album),* golden pea *(Thermopsis rhombifolia),*
(Rumex venosus), and narrow-leaved skeletonweed (*Stephanomeria tenuifolia).* The shale has high water retention, so deep-rooted mesic species like *Spartina gracilis* were found, in one instance growing near the middle of a steep, open slope. Despite its open habitat for colonization, exotic species are few.

Indian ricegrass *(Oryzopsis hymenoides)* was rarely present in this plant association as it occurred in the study area. The *Artemisia longifolia/Oryzopsis hymenoides* p.a. which has been identified as a BLM special status community type (USDI Bureau of Land Management 1996) is believed to be a variable phase of the ARTLON p.a. which is appropriate to reclassify and to rerank as potentially secure (S4) in the state in light of the locally widespread distribution and general lack of threats.

***Sarcobatus vermiculatus/Agropyron smithii* p.a.** (G4 S4)
(SARVER/AGRSMI; greasewood/western wheatgrass; no plot)

Environment: SARVER/ATRGAR c.t. is an alkaline community type on outwash flats as well as on badlands slopes. It is scattered along the Missouri River and Woodhawk Creek valley walls.

Vegetation: Greasewood usually has a cover of about 10%. Associated species include: Gardner's saltsage (*Atriplex gardneri)*, povertyweed (*Iva axillaris),* gumweed *(Grindelia squarrosa)*, cheatgrass (*Bromus tectorum)* and field milk-thistle *(Sonchus arvensis)*. Some study area examples are noteably weedy. This type grades into other poorly-sorted badlands slope associations and unvegetated slopes.

Gardner's saltbush was not consistently present, so it does not fit into the *Sarcobatus vermiculatus/ Atriplex gardneri* p.a. which was identified as a BLM special status community type (USDI Bureau of Land Management 1996) based on work in the Pryor Mountains (Lesica and DeVelice 1993). This status warrants reconsideration and the latter is recommended for deletion based on the results of survey work in northeastern Montana (DeVelice et al. 1995). It has also been documented along the Front Range in northcentral Montana (Heidel in progress), so it is not nearly as restricted and vulnerable as originally thought.

Vegetation Descriptions: GRASSLAND TYPES

***Agropyron spicatum- Poa secunda* c.t.**. (G5 S5)
(PSESPI-POASEC; bluebunch wheatgrass-Sandberg's bluegrass; 1 plot)

Environment: This is expressed as a rare seral community type, and is apparently restricted in the study area to old burns. Among the best-developed examples was one on a sheltered midslope bench setting.

Soils: The soils are located within areas mapped as Dilts-Julin-Rock outcrop complex. The other seral plant association that was identified following fire in the study is *Artemisia tridentata ssp. vaseyana/Agropyron spicatum* c.t., which may correspond with a soil pH difference as well as climax vegetation.

Vegetation: This is a well-developed type elsewhere in the state, but appears to be a minor seral type based on charred stumps in the area. It potential climax community is undetermined. The cover of bluebunch wheatgrass (*Agropyron spicatum* syn. *Elymus sspicatus, Pseudoroegneria spicatum*) exceeded 30% in the single plot that was sampled, and the *Poa secunda* cover was app. 10%. It was a mesic site with woodland forbs like *Arnica soraria* (10%) and *Smilacina stellata* (trace), plus locally uncommon grassland species such as *Stipa curtiseta.*

Bouteloua gracilis - Carex filifolia p.a. (G4 S4)
(BOUGRA-CARFIL; blue grama - thread-leaved sedge; 2 plots)

Environment: BOUGRA-CARFIL p.a. is found in the study area associated with sandstone escarpments. It is most often found on small terraces or eyebrows, and sandy outwashes, though it was sometimes also found at midslope benches and small ridgelines. It is restricted to low productivity range, often in secondary range settings, where there is no direct evidence to characterize it as a product of overgrazing.

Soils: The soils are fine sands eroded from the sandy members of the Delpoint soil series.

Vegetation: This shortgrass prairie type includes exotic and ruderal species like desert alyssum (*Alyssum desortum)* and gold-of-pleasure *(Camelina sativa*), as well as drought-tolerant native species not found elsewhere locally like Drummond false pennyroyal (*Hedeoma drummondii)* and tansy aster *(Machaeranthera tanacetifolia*). One of the species that consistently occurred in the BOUGRA c.t. and hardly any where else was bracted plantain (*Plantago aristata)*, which is considered to be native to the eastern Great Plains but naturalized over much of the continent (Great Plains Flora Association). It appears that this species has not been reported before from the state flora, an initial assessment which is under investigation.

Stipa comata-Agropyron smithii p.a. (G5 S5)
(STICOM-AGRSMI; needle-and-thread - western wheatgrass; 1 plot)

Environment: STICOM-AGRSMI p.a. occurs on rolling uplands overlying sandstone caprock. The largest and best-developed example of this type, as pointed out by Jim Sparks, is in a 3-acre area used as a holding pen over 30 years ago that now excludes livestock. The gently-rolling soils are well-drained. It adjoins the preceding RHUTRI/ANDSCO p.a.

Soils: Soils are mapped as part of the Yawdim-Delpoint-Rock outcrop complex, 25-50% slope (USDA Soil Conservation Service 1979). The Delpoint series includes soils developed from sandy parent material, while most of the series is characterized as part of shallow or silty range sites. The sampling of vegetation was conducted at a plot with fine sand.

Vegetation: The grassland vegetation in these small areas had shifts in dominance over small distances, so that sampling over homogeneous areas was difficult to find and subjectively selected. The relative dominance of the three primary grasses varied but usually had cover of needle-and thread (*Stipa comata*) over 20%, western wheatgrass (*Agropyron smithii*; syn. *Elymus smithii*) over 10%, and blue grama (*Bouteloua gracilis*) over 10%. Compact selaginella (*Selaginella densa)* was abundant, making up about 30% of the groundcover. Fringed sagewort (*Artemisia frigida)* cover ranged from 0-5%. The most common forb was silver-leaved scurf-pea (*Psoralea argophylla)*. It includes many grassland forbs

which are not found elsewhere in the study area, like dotted gayfeather (*Liatris punctata),* white penstemon *(Penstemon albidus)*, and prairieclover (*Dalea* spp.). This type is widespread elsewhere in the state.

Vegetation Descriptions: Riparian and Wetland types

Agropyron smithii p.a. (G3G5 S4)
(AGRSMI; western wheatgrass p.a.; no plots)

Environment: AGRSMI is a facultative wetland species. In other words, it can grow in wetland habitat but is not restricted to wetland habitat and is in fact a terrestrial co-dominant in the uplands. It is provisionally identified as the dominant species in the following setting based on vegetative material. The setting is in small, shallow ephemeral upland swales that have evaporated by June. Only two examples were seen and they had dimensions and locations which are consistent with buffalo wallows.

Soils: The substrates are silty clay.

Vegetation: Emergent vegetation dominated by western wheatgrass (cover greater than 30%) fills the basins. The swales are heavily used and trampled by livestock, have mainly ruderal and exotic species like Canada bluegrass (*Poa compressa)*, and have low species diversity.

***Eleocharis palustris* p.a.** (G5 S5)
(ELEPAL; common spikesedge; no plot)

Environment: ELEPAL p.a. is the dominant or most abundant emergent vegetation in small, shallow pools that form in slump blocks on north-facing slopes. These settings are the least alkaline surface waters found in the study area apart from the Missouri River. While they do not have fresh water conditions, they are probably in a water chemistry range of slightly brackish to moderately brackish, as inferred by the water chemistry ranges of the dominant species and associated species (Stewart 1972). They are in partially-shaded settings with woods along a segment of the shore, enhancing the habitat diversity and wildlife values. The substrates are muck.

Vegetation: ELEPAL p.a. has the highest species diversity among local wetland communities. Associated species include short-awn foxtail (*Alopecurus aequalis),* American waterplantain *(Alisma plantago-aquatica),* foxtail barley *(Hordeum jubatum),* low cudweed *(Gnaphalium palustre),* bractless hedge-hyssop *(Gratiola neglecta),* mudwort *(Limosella aquatica),* American waterwort *(Elatine americana)* and fowl bluegrass *(Poa palustris).* Livestock use of this habitat is light and intermittent under current management.

Juncus balticus **p.a.** (G5 S5)
(JUNBAL; Baltic rush; no plot)

Environment: JUNBAL p.a. is one of the two most common wetland vegetation type in Woodhawk Creek tributaries along with *Scirpus americanus* p.a. The tributary setting makes up the most extensive wetland habitat in the study area. Both are usually present in the same stream-reach, forming a mosaic with one or the other assuming primary dominance. The water regime is seasonally inundated and the water chemistry is alkaline.

Vegetation: This expression of the JUNBAL p.a. is dominated by *Juncus balticus* var. *balticus*, a species dominant which has not been as well documented in the state as *J. balticus* var. *montanus.* This plant association is characterized as a grazing disclimax in Hansen et al. (1995) but the grass species which it is said to replace are not to be found in the study area and rarely in the Great Plains. It is interpreted to be naturally dominant in some settings.

Puccinnellia nuttalliana **p.a.** (G1 S-)
(PUCNUT; Nuttall's alkaligrass; no plots)

Environment: PUCNUT p.a. is found in small saline seeps of the Woodhawk and Missouri River valleys, and salt-accumulating borders of alkaline headwaters.

Vegetation: Associated species included inland saltgrass *(Distichilis stricta),* foxtail barley *(Hordeum jubatum),* alkali cordgrass *(Spartina gracilis)*, alkali sacaton (*Sprobolus airoides)*, and slender arrowgrass (*Triglochin concinnum* var. *debile)*. This plant association has not previously been reported in the state. It is recommended for addition to the state list with status undetermined (SU).

It has been reported previously in Colorado (Ungar 1974), and is likely in the Canadian literature. An association of Nuttall's alkaligrass and inland saltgrass is recognized in western North Dakota (Jensen et al. 1992). It is also found around closed basin wetlands in North Dakota and now documented in northcentral Montana (Heidel in progress). It is not appropriate to consider as globally imperilled (G1) but is recommended that its rank be changed to undetermined (GU) while extended literature review and data synthesis is taking place.

Botanical Results

One sensitive plant was documented from the Woodhawk study area, little indian breadroot (*Psoralea hypogaea)*. The search for persistentsepal yellowcress (*Rorippa calycina*) came up with negative results, which we present and discuss in the results section to refine its search image in Montana.

A total of 245 species of vascular plants in 55 families were identified in the Woodhawk study area (Appendix D). This is a relatively low number for a large plains area with sharp topographic relief and it is interpreted to indicate a depauperate flora. Part of this is thought to be due to the pervasive, constraining influence of the montmorillonitic clays. Despite the range of habitats, there were several upland species that were nearly ubiguitous in all plant associations (*Agropyron smithii, Artemisia tridentata, Allium textile, Vicia americana*). There were also many common Montana plants species and genera, both native and exotic, which were altogether absent from the area (*Amelanchier alnifolia, Galium* spp., *Helianthus annuus, Bromus inermis, Trifolium* spp.).

One potential new addition to the flora that was identified, bracted plantain (*Plantago aristata*), and it is common where the *Bouteloua gracilis-Carex filifolia* p.a. occurs. A literature review is underway to determine whether this has been documented before in Montana, and whether it is more likely to be a naturalized exotic from eastern North America (like Kentucky bluegrass, or a native species.

Three species which were once considered Montana Plant Species of Special Concern were documented in the study area, including American waterwort (*Elatine americana*), many-stemmed goldenweed (*Haplopappus multicaulis*) and slender arrowgrass (*Triglochin concinnum* var. *debile*). They have since been deleted because they are more common than had been previously known. A photograph of the multi-stemmed goldenweed is included in Appendix E.

Most communities have relatively low diversity as indicated by the number of species per macroplot. This forms the basis for saying that any given segment of landscape has relatively low diversity and that study area diversity is tied to the landscape diversity. The corollary to this is that relative landscape intactness is integral to diversity.

There is a potential gap in the sensitive species search thoroughness in addressing the late-season flora, particularly in wetland habitat and some segments of the woodland habitat. However, those wetlands habitats that are not highly alkaline were extremely small and already beginning to evaporate and expose mudflats with associated species in June. The woodland habitats seemed to have relatively little of the rare eastern deciduous forest component. An August evaluation of the wetland flora in the southeastern corner of the area, and of pine woodland flora on the south side of Woodhawk Creek, particularly those species of the Aster Family and Sedge Genus, would provide a double-check on this assessment.

The following pages provide the most current status information on *Psoralea hypogaea* and *Rorippa calycina.*

Psoralea hypogaea Nutt. ex T. & G.[2]
Little indian breadroot

FAMILY: Fabaceae (Bean Family)

GENUS: *Psoralea* (scurf-pea)

SPECIES: *P. hypogaea*, from the Greek word **hypo**, meaning "beneath", and the Greek word **gaea**, referring to the earth. Like the more common *P. esculenta* (indian breadroot), the elongate taproot of *P. hypogaea* is thickened into a swollen carbohydrate-rich storage organ below ground that is edible.

STATUS

U.S. FISH AND WILDLIFE SERVICE: None.

BUREAU OF LAND MANAGEMENT: Watch in all resources areas where it is known to date, including the Great Falls Resource Area, and the Powder River Resource Area (USDI Bureau of Land Management 1996). As a result of this work, it is recommended for addition as watch to the Judith Resource Area.

U.S. FOREST SERVICE: None; it does not appear to reach the elevations of national forests in Montana.

GLOBAL RANK: It has a global rank of G4? indicating that it may be secure rangewide as determined from compiled information among state natural heritage programs. The question mark is included because it has been noted that it appears to be rare throughout its range (Great Plains Flora Association 1986). The Montana studies that were done in 1996 indicate that its occurrences may be under-represented.

STATE STATUS: Its original State Rank was "S1", indicating that it is critically imperiled. This study provides the basis for changing its rank to "S2" meaning that it may be imperiled (usually based on 6-20 records in the state. As of 1996 there are a total of nine records to date, from four counties; one of which is historic and unrelocatable.

It was previously placed in the "threatened" category by Lesica and Shelly (1991), but neither this treatment or the state rarity rank confer a protection status.

DESCRIPTION

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[2]The following species status text updates that presented in Heidel (1994).

GENERAL NONTECHNICAL DESCRIPTION: Little indian breadroot is an herbaceous perennial with a compact spike-like infloresence of purple flowers connected to the taproot with little or no vestige of a flowering stalk, overtopped and partly hidden by silvery leaves made up of usually five palmate leaflets (Figure . *Psoralea hypogaea*, close-up). The leaves lie appressed to the substrate. It produces relatively inconspicuous one-seeded pods.

TECHNICAL DESCRIPTION: Perennial acaulescent herbs or rarely with stems 1-2 cm long and internodes very short; taproot apically thickened into a globose or fusiform storage organ 3-8 cm below surface; caudex a knobby, usually conical structure at apex of storage organ, producing 1(2-4) vertical slender stipule-bearing branches which enlarge at surface to produce crown of the season. Leaves palmately 3-5(7)-foliate, entirely covered with densely appressed white pubescence or upper surface of leaflets becoming glabrate; leaflets linear-elliptic, linear-lanceolate to rarely narrowly obovate, (1.5) 2.5-5 cm long, 4-9 mm wide; petioles (2)4-9(12) cm long; stipules lanceolate to ovate, 0.5-2 cm long, scarious. Peduncles very short to rarely as long as leaves in fruit; spike dense; bracts ovate-acuminate or lanceolate, scarious, 5-8 mm long, glabrous above, strigose below, ciliate. Calyx tube 4-5 mm long, hirsute, 4 upper teeth lanceolate, 5-7 mm long, lower tooth 9-11 mm long and 3-4 mm wide, 3-veined; corolla blue or violet, fading yellowish; banner ovate-oblong, blade 10-13 mm long, claw 2-3 mm long; wing narrowly oblong, 9-10 mm long, claw 2-3 mm long; free portion of keel 3-4 mm long. Pod ovoid, 5-6 mm long, hirsute, tapering into a beak 8-13 mm long, pericarp thin in lower 1/3, leathery above, irregularly circumscissile; seed 4-5 mm long, 2.5-3 mm wide, 2 mm in diam, faces with conspicuous irregular rounded ridges, olivaceous or pinkish-gray (Great Plains Flora Association 1986).

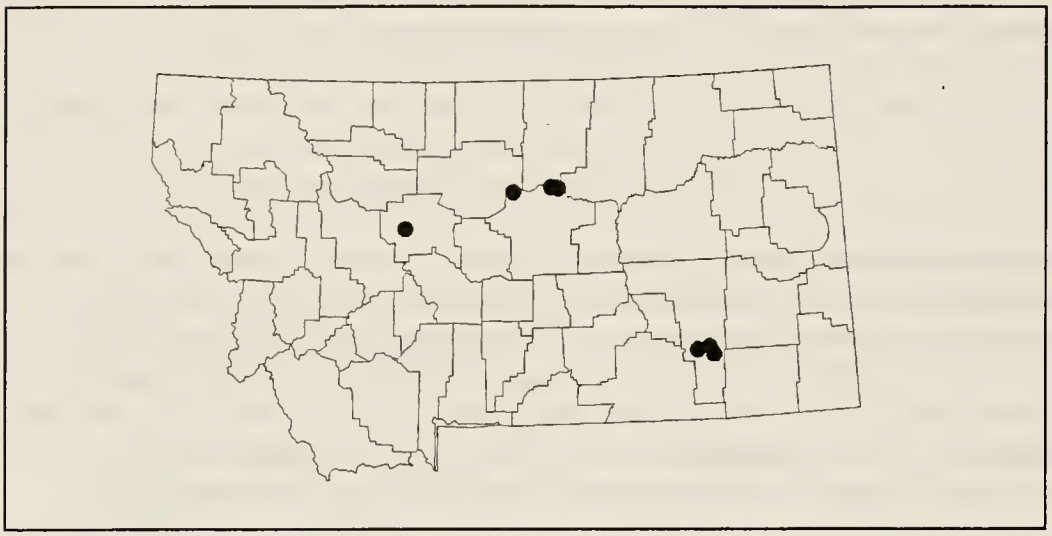
LOCAL FIELD CHARACTERS: Little indian breadroot superficially resembles other palmately-leaved legumes, which are known to or are expected to occupy similar habitats in Montana. It most closely resembles common indian breadroot, but unlike this species, it has an infloresence **much shorter** than the leaves, without a central flowering stalk or a highly reduced flowering stalk. This gives it the appearance of hugging the ground (Figure). Compared to common indian breadroot it also has appressed pubesence instead of hirsute leaves, its flowers are smaller at 10-13 mm as compared to ca. 15 mm., darker in color, the calyx tube is shorter at 3-4 mm as compared to ca. 5 mm., and the calyx tube lobes are larger on the bottom as compared to equal in size.

If the infloresence of little indian breadroot is overlooked or the plant is in vegetative condition, it might be mistaken for an immature lupine. There are other legumes in similar habitat that remotely resemble little indian breadroot which have only three-leaflet compound leaves and other differences. These species include yellow goldenpea (*Thermopsis rhombifolia*), which is also distinguished in having a yellow flower, silverleaf (*Psoralea argophylla*), which is also distinguished in having an open racemose infloresence, and small lupine (*Lupinus pusillus*), which is an annual with a distinct flowering stem. The latter was not found at the Cascade Co. site but might be expected to overlap with little indian breadroot elsewhere in its habitat.

GEOGRAPHICAL DISTRIBUTION

RANGE: Little indian breadroot is restricted to the Great Plains, extending from Montana to New Mexico, and eastward as far as western South Dakota, Nebraska, Kansas and Oklahoma (Great Plains Flora Association 1976). Montana represents the northern end of its distribution.

CURRENT SITES: Eight relocatable sites represent the current known distribution of little indian breadroot in Montana.



Four records are from Rosebud County including two from BLM lands, and two on mining company lands. At the latter sites, little indian breadroot grows mainly on native habitat but is also found on reclaimed land (Scow pers. commun.). A systematic search of sandy range sites in this area would help resolve whether it warrants recognition as a watch species by the BLM.

One is from Cascade County (Heidel 1994). One record is from Choteau County along the Missouri River breaks upstream from the study area. The two new collections in Fergus County fill gaps in the species' distribution. A systematic survey of Missouri Break slopes associated with sandstone outcrop would help resolve whether it warrants recognition as a watch species by the BLM. The study area records from Fergus County are printed out in Appendix x.

HISTORICAL SITES: The first collection in Cascade County was made in 1882, and the label information said only "Great Falls". If it was collected at the actual townsite, then the population is likely to be extirpated. Sandy habitats in the immediate vicinity of town include now-inundated Missouri River terraces, the radio tower buttes north and northwest of town, and the bluffs of Sand Coulee southeast of town. It is presumed extirpated.

UNVERIFIED/UNDOCUMENTED REPORTS: None. Incompletely surveyed areas of potential habitat are described in the previous discussion of current sites.

HABITAT

ASSOCIATED VEGETATION: The vegetation associated with little indian breadroot is sand prairie. In the study area, this habitat is very localized; only four areas with over an acre of potential habitat were found, two of which harbored little indian breadroot.

The western uplands population (EO#007) has the most extensive, and well-developed sand prairie plant association. The largest segment of the population is in vegetation dominated by Bouteloua gracilis on sandy outwash toeslopes. This shortgrass association is recurrent through the study area, and an ecodata plot was placed in this habitat (96HEI0xx). On the south-facing, sandy slopes above, little indian breadroot is present in low numbers with variable seral dominants or co-dominants like Andropogon scoparius and Rhus trilobata. The floodplain population (EO#008) is in a sandy phase of the *Stipa comata - Bouteloua gracilis* plant association.

A composite list of associated species is presented below. Associated species that occur with little indian breadroot in the Woodhawk study area are indicated by their EO numbers:

Agropyron smithii
Agropyron spicatum
Allium textile (#008)
Andropogon scoparius (#008)
Artemisia cana
Asclepias verticillata
Asclepias viridiflora (#008)
Astragalus adsurgens (#008)
Astragalus lotiflorus (#008)
Astragalus missouriensis (#008)
Astragalus vexilliflexus
Bouteloua gracilis (#007, #008)
Bromus brizaeformis (#008)
Bromus tectorum
Calamovilfa longifolia (#008)
Carex filifolia (#008)
Castilleja sessiliflora (#008)
Cryptantha torreyana (#008)
Erigeron pumilus (#008)
Eriogonum annuum

Eurotia lanata (#008)
Gutierrezia sarothrae
Hymenopappus filifolius (#008)
Koeleria macranta
Linum ruderale (#008)
Lithspermum arvense
Lupinus argentues
Lupinus lepidus (#008)
Lygodesmia juncea
Melilotus officinalis (#008)
Opuntia polyacantha (#008)
Oryzopsis hymenoides (#008)
Penstemon spp. (#008)
Phlox hoodii (#008)
Plantago aristatus (#008)
Psoralea argophylla
Psoralea esculenta
Polygala alba
Rhus trilobata (#008)
Rumex venosus
Salsola kali
Sphaeralcea coccinea (#008)
Sporobolus cryptandrus
Stipa comata (#008)
Sporobolus cryptandrus
Thermopsis rhombifolia
Tradescantia occidentalis
Yucca glauca (#007, #008)

Vegetation often has a high component of legumes besides little indian breadroot. All legumes are nitrogen fixers, thus able to grow on sterile soils. Seral plant communities have low vegetation composition, so they are particularly vulnerable to weed invasion. Yellow sweetclover (Melilotus officinalis) is present though not common in the study area. It has become a serious management problem downstream in the Charles M. Russell National Wildlife Refuge, and its potential invasion is a threat.

SOIL RELATIONSHIPS: Soils are psamments, with little or no horizon development and organic component. They are usually in the "sands" soil texture category and sands or sandy range sites, which are the droughty, with rapid water percolation and almost no water-retaining capacity. They are deposited as colluvium or alluvium, sometimes reworked into sand dunes.

REGIONAL CLIMATE: Soils developed under a continental climate with mean annual precipitation of 14-16 inches, and a growing season of 105-135 days. The Woodhawk study area climate is discussed in more detail in the study area description.

POPULATION BIOLOGY

PHENOLOGY: Flowering takes place as days lengthen and temperatures increase late in the spring. Fruits mature in June, typically the month of peak rainfall. The phenological window during which plants are most conspicuous corresponds with flowering, though identification can be made with certainty any time while the infloresence persists through at least early July.

POPULATION SIZE AND CONDITION: Little indian breadroot is common at three of the eight extant population sites, including one in the study area. These three include:

004 Choteau
006 Rosebud
007 Fergus

The other sites have population estimates below 10. Population size information is missing from the Rosebud County mine sites.

REPRODUCTIVE BIOLOGY

TYPE OF REPRODUCTION: Reproduction is sexual; it is not known to what degree selfing occurs. Plants are dieocious and flowers are perfect.

POLLINATION BIOLOGY: Bumblebees were observed. Bees are pollen vectors for many legumes. Population numbers of little indian breadroot might be limited by pollination.

SEED DISPERSAL AND BIOLOGY: The single-seeded fruits crack and rupture with drying rather than having a line of dehisence. It is likely that little indian breadroot seeds disperse like the seeds of common indian breadroot, scattering when the dried infloresence breaks off at the base of the stem and is blown and tumbled by the wind.

MANAGEMENT: Little indian breadroot occupies mainly secondary range. It is adversely affected by grazing which changes the vegetation composition to increase competition, particularly with exotic species. It is also potentially impacted by range developments like roads, fences, and water developments.

There were no immediate threats identified in the study area. The eastern population is small and the potential habitat is very limited, so the occurrence was ranked as poor, signifying low contribution to species conservation. The western population is one of the three populations where numbers exceed , ranked as good-excellent. It occupies eroding sandstone escarpments that are rarely used by livestock and low productivity primary range on the sands toe slopes. Invasion by yellow sweetclover is rampant on other segments of the Missouri Breaks and it is recommended that current and projected yellowsweetclover conditions be included as potential management concerns in future study area management plans.

We have yet to systematically survey for this species over large areas of potential habitat, so that the highest species' conservation priority is to expand the field survey work elsewhere. I f there are areas in the Missouri Breaks where it is recurrent and without threat, then it will not be appropriate to recognize as a BLM watch species or as a Montana Plant Species of Special Concern.

***Rorippa calycina* (Engelm.) Rydb.**
Persistentsepal yellowcress

This species was not documented in the Woodhawk study area, but has been collected upstream on the Missouri River, as represented in a 1990 collection from the White Cliffs area (Lackschewitz 11642 MONTU, presented as EO#005). The following is a brief addition to and commentary on the most recent state status information (Heidel 1994).

Persistentsepal yellowcress warrants special concern because it is a regional endemic. There are no known populations extant in Montana or North Dakota. It is otherwise known from five counties in Wyoming. It is ranked as globally vulnerable (G3). Both of the two collections of this species that were made this century in Montana are considered to be extirpated. At the White Cliffs collection site, only one plant was found, and it was collected. The three other Montana collections were made before the turn of the century and have vague locality information.

This species is thought to be absent in the study area because of the substrate unsuitability of the Bear Paw shale alluvium for colonization and establishment. In Wyoming, it has been documented most often on sandy substrate, less often on silt, and least often on clay. The White Cliffs specimen upstream from the study area was collected from gravel.

There is a common yellowcress species which field investigators need to differentiate from the rare species. It is spreading yellowcress (*Rorippa sinuata*), the only other perennial yellowcress in the state. It overlaps in distribution with *R. calycina,* and it grows along the Missouri River shoreline, but in a wider variety of substrates and settings than persistentsepal yellowcress. It was documented by voucher and photograph at two river's edge sites in the study area: T.23N R.22 E Sec. 19 and T23N R.21E Sec. 4. It was also found in two areas adjoining the study area on an island, and on the opposite side of the river. It has fruits which taper at the tip rather than having an oval outline, and they are over 5 mm long and glabrous rather than shorter than 5 mm long and pubescent. Illustrations of both species and photographs of the common species are included in Appendix .

CONCLUSION

The highest biodiversity significance identified in the Woodhawk study area rests in the composite community heterogeneity of the Missouri Breaks landscape rather than in the global or state rarity of the components. In general, the Woodhawk allottment possesses a high number of plant community types for an area its size. It also has several plant community types typical for eastern Montana which have not been well-documented in the state ecological literature.

The study provides new information of use in the project area, resource area, the Missouri River corridor, and the state. In spirte of the fact that the Woodhawk study area has limited sensitive species and plant community significance and low overall floristic diversity, the total number of plant communities is noteworthy, and half of the plant communities (10 of 20) are underdocumented if not rare.

The three highest priority features proposed for BLM watch status include:

	Current BLM Status	Proposed BLM status
Little indian breadroot *Psoralea hypogaea*	Watch	Watch
Agropyron smithii p.a.	Watch	Delete
Artemisia longifolia/Oryzopsis hymenoides p.a.	Watch	Delete
Pinus ponderosa/Carex heliophila p.a.	Watch	Watch
Pseudotsuga menziesii/ Oryzopsis micrantha p.a.	-	Watch

There are no features recommended for sensitive status since there are no imminent management impacts to the features under current conditions, though they may be vulnerable to activities which would intensify on-site land use or promote spread of noxious weeds.

The highest priority activity for each of these watch features is to expand the scope of survey. Sands and sandy range sites are potential habitat for little indian breadroot, so sensitive species survey is recommended in conjunction with range analysis for proposed projects which potentially alter land uses in this setting. New developments (roads, stockdams, and fencelines) should be avoided on or adjoining population sites. The status of little indian breadroot will be examined if new sites of it are documented.

The plant associations proposed for watch status are the least common of the upland timber types, and are at opposite ends of the moisture gradient. On-site community survey is recommended in the course of project reviews when the two timbered plant associations are potentially affected, to avoid impacting the largest and oldest examples of these types. The state status of these types will automatically be examined if new sites in good condition are documented.

The wetland habitats, though they do not have discrete biodiversity significance in their own right, are integral to landscape diversity and balancement management. For this reason, the wetland areas which are currently in fair-excellent condition are recommended as additional biodiversity management concerns, and these include headwaters riparian wetlands and isolated catchment basins.

The methodology employed in this study, in abbreviated form, is presented as a template for routine project reviews.

- Check for special status plant species and plant association records and in and around the project area. Use existing information to identify likely features of significance.

- Set species and plant association search targets.

- Survey appropriate habitat at the appropriate times of the growing season.

- Collect information on any sensitive plant populations and plant associations, also documenting them photographs and specimens.

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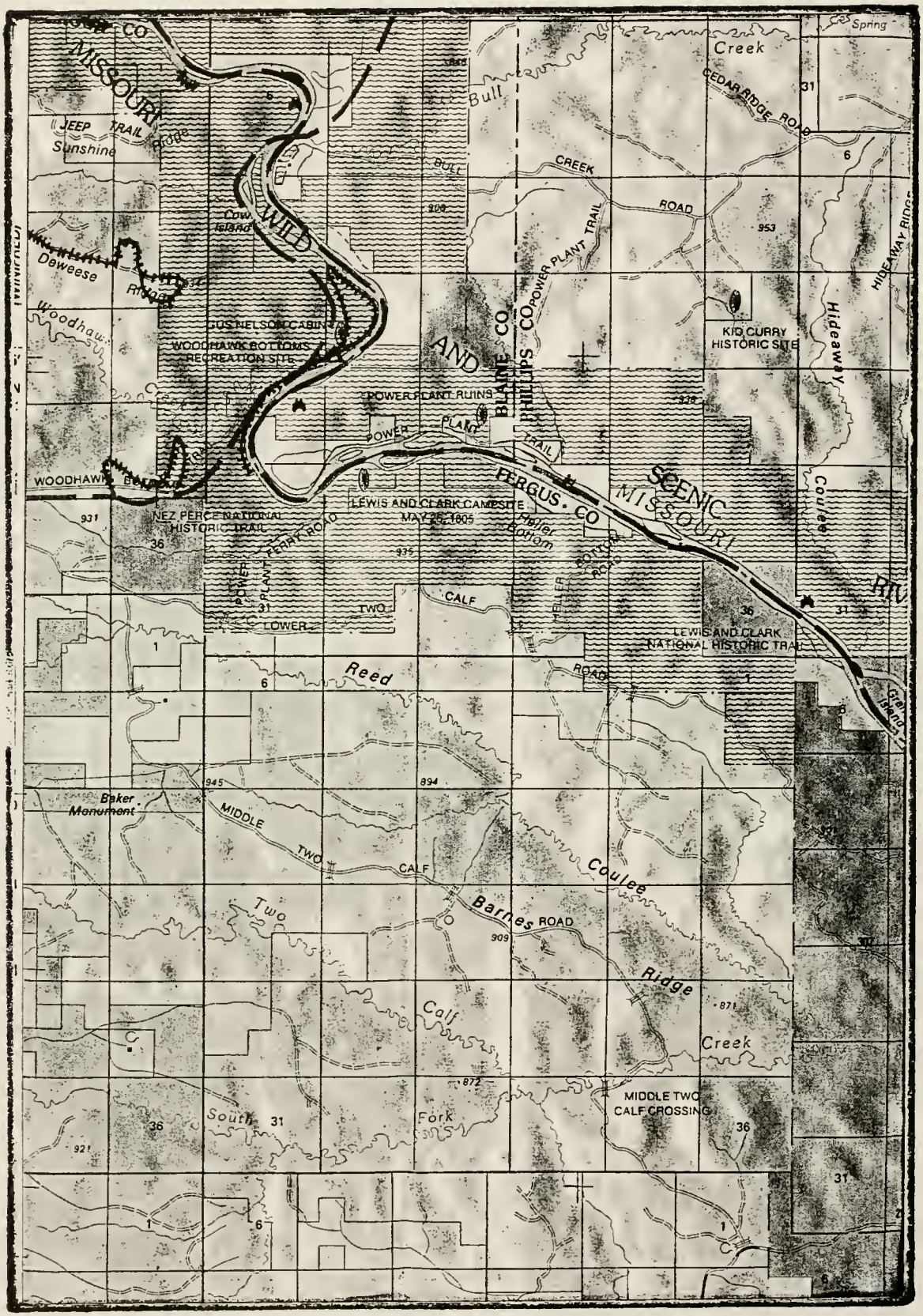
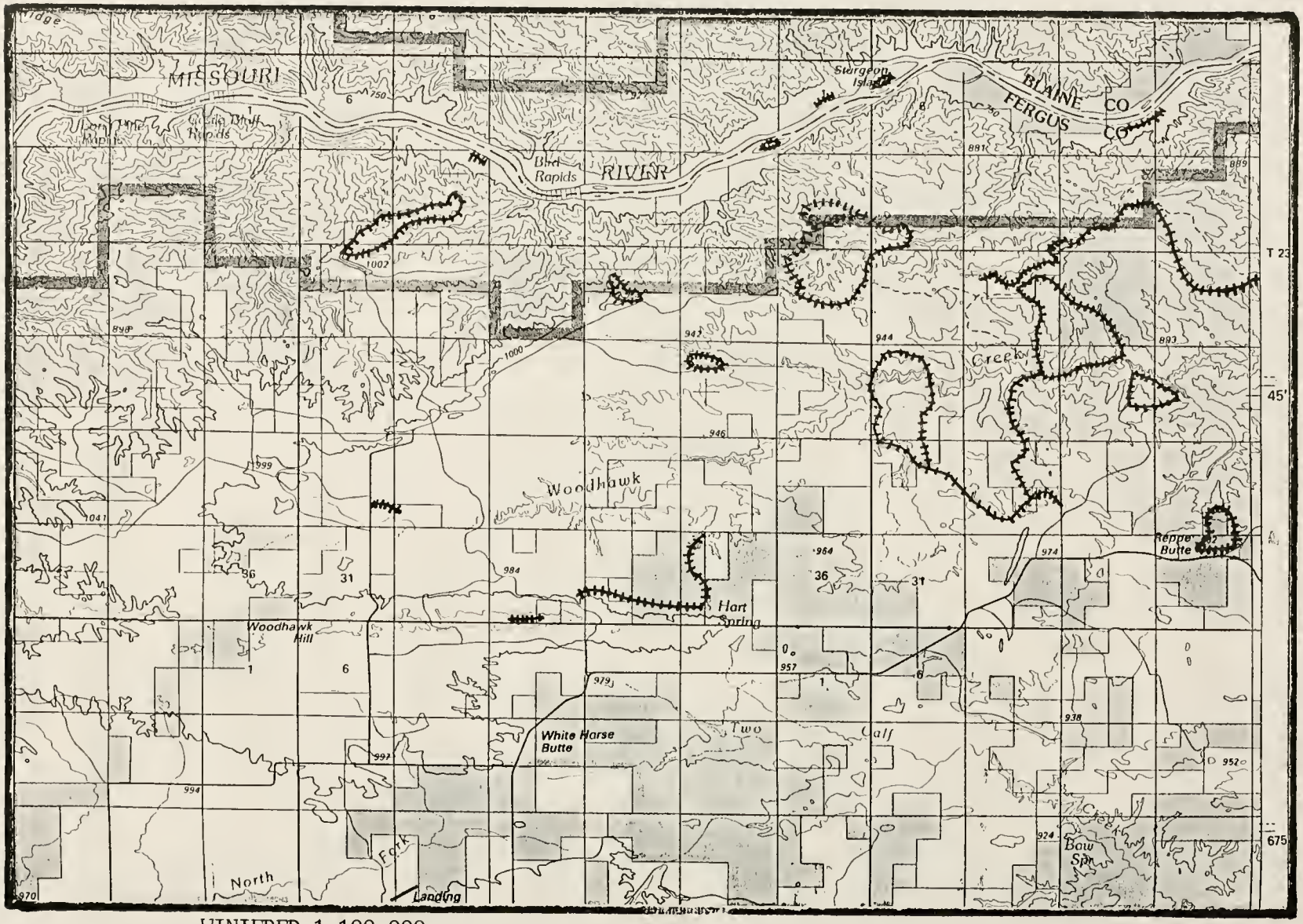
Appendix A. Botanical survey routes in the Woodhawk study area

SURVEY ROUTES



ZORTMAN 1:100,000

SURVEY ROUTES



WINIFRED 1:100,000

Appendix B - Plant Element Occurrence Records and topographic maps showing locations

SENSITIVE SPECIES IN WOODHAWK PROJECT AREA

Scientific Name: PSORALEA HYPOGAEA
Common Name: LITTLE INDIAN BREADROOT

Global rank: G4? Forest Service status:
State rank: S1 Federal Status:
Element occurrence code: PDFAB5L0C1.007
Survey site name: SPRUCE VABM
EO rank: AB
EO rank comments: GOOD NUMBERS IN RANGE OF LOCAL MICROHABITATS.

County: FERGUS
USGS quadrangle: STURGEON ISLAND
Township: Range: Section: TRS comments:
023N 021E 17 NE4; 9 SW4SW4
Precision: S
Survey date: 1996-06-24 Elevation: 3120 - 3270
First observation: 1996-06-24 Slope/aspect: 5-30% / SW-SE
Last observation: 1996-06-24 Size (acres):
Location: CA. 14 AIR MILES EAST AND 14 AIR MILES NORTH OF WINIFRED. ACCESSIBLE VIA WOODHAWK CREEK CROSSING ROAD NOT SHOWN ON MAPS. POPULATION LIES BOTH EAST AND WEST OF OLD CABIN.

Element occurrence data: 100-200 PLANTS IN BUD AND EARLY FLOWERING 24 JUNE 1996. HIGHEST NUMBERS AND DENSITY ARE AT ONE TOESLOPE AREA OF THE WESTERN ESCARPMENT, WITH SCATTERED CLUSTERS OF PLANTS AT TOP OF RIDGE ALONG ITS LENGTH. A SMALL OUTCROP AREA IN SECTION 9 ALSO HAS 5 PLANTS BELOW RIM.

General site description: LOCALIZED SANDSTONE ESCARPMENTS IN MISSOURI BREAKS. THE TOESLOPE HABITAT IS DOMINATED BY BOUTELOUA GRACILIS ON AN EVEN, GENTLE SLOPE AT THE BASE OF OUTCROP. THE RIDGETOP HABITAT LIES RIGHT BELOW THE ABRUPT EDGE OF SOUTH-FACING SLOPES ON SPARSELY-VEGETATED LOOSE SLOPES WITH PINUS PONDEROSA, ANDROPOGON SCOPARIA, AND CALAMOVILFA LONGIFOLIA. ASSOCIATED SPECIES IN BOTH SETTINGS INCLUDE YUCCA GLAUCA, CAREX FILIFOLIA AND ALLIUM TEXTILE.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: LEWISTOWN DISTRICT, JUDITH RESOURCE AREA

Comments:
LIVESTOCK USE IS LIGHT OR ABSENT WHERE THIS SPECIES OCCURS.
Specimens: HEIDEL, B. (1471). 1996. MONTU.

PSORALEA HYPOGAEA 007
STURGEON ISLAND

SENSITIVE SPECIES IN WOODHAWK PROJECT AREA

Scientific Name: PSORALEA HYPOGAEA
Common Name: LITTLE INDIAN BREADROOT
Global rank: G4? Forest Service status:
State rank: S1 Federal Status:

Element occurrence code: PDFAB5L0C1.008
Survey site name: COW ISLAND
EO rank: D
EO rank comments: LIMITED HABITAT EXTENT; FAIR CONDITION.
County: FERGUS
USGS quadrangle: COW ISLAND

Township:	Range:	Section:	TRS comments:
023N	022E	18	SE4

Precision: S
Survey date: 1996-06-20 Elevation: 2320 -
First observation: 1996-06-20 Slope/aspect: 5% / SSE
Last observation: 1996-06-20 Size (acres):

Location: 14 AIR MILES NORTH AND 21 AIR MILES EAST OF WINIFRED; 0.5 MILES NOUTHEAST OF WOODHAWK BOTTOMS ON WEST SIDE OF 2-TRACK AND ABANDONED HOMESTEAD.

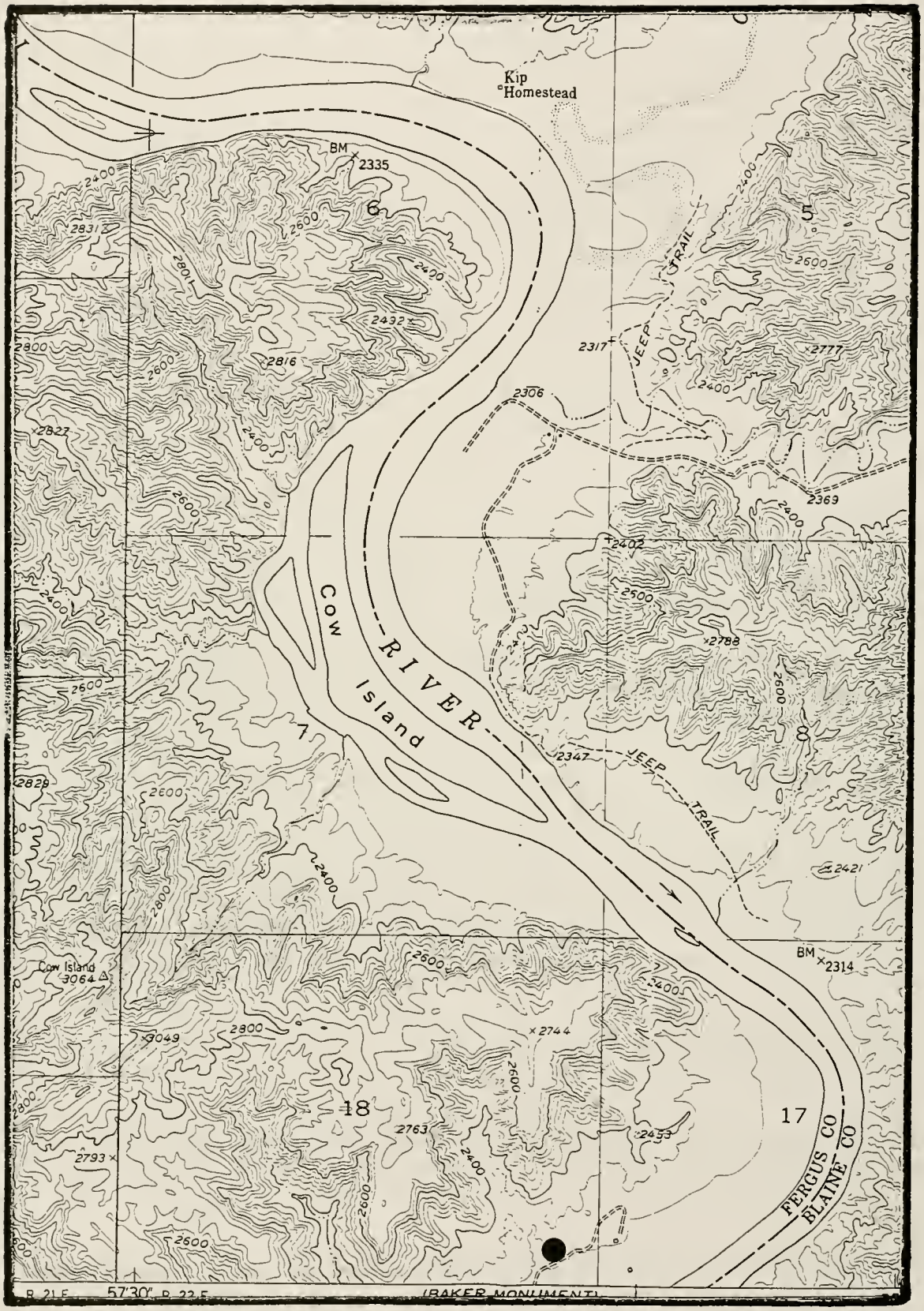
Element occurrence data: 2 PLANTS APPROACHING PEAK FLOWERING 20 JUNE 1996.

General site description: MISSOURI VALLEY BOTTOMS, IN DRY OPEN VALLEY ON SMALL SANDY MOUND DERIVED FROM BLUFF OUTCROPS. LOCAL DOMINANTS ARE STIPA COMATA AND BOUTELOUA GRACILIS. ASSOCIATED SPECIES: YUCCA GLAUCA, HYMENOPAPPUS FILIFOLIUS, ASTRAGALUS MISSOURIENSIS. NOT ASSOCIATED WITH PSORALEA ARGOPHYLLA AND LUPINUS LEPIDUS NEARBY.

Land owner/manager:
UPPER MISSOURI WILD & SCENIC RIVER
BLM: LEWISTOWN DISTRICT, JUDITH RESOURCE AREA

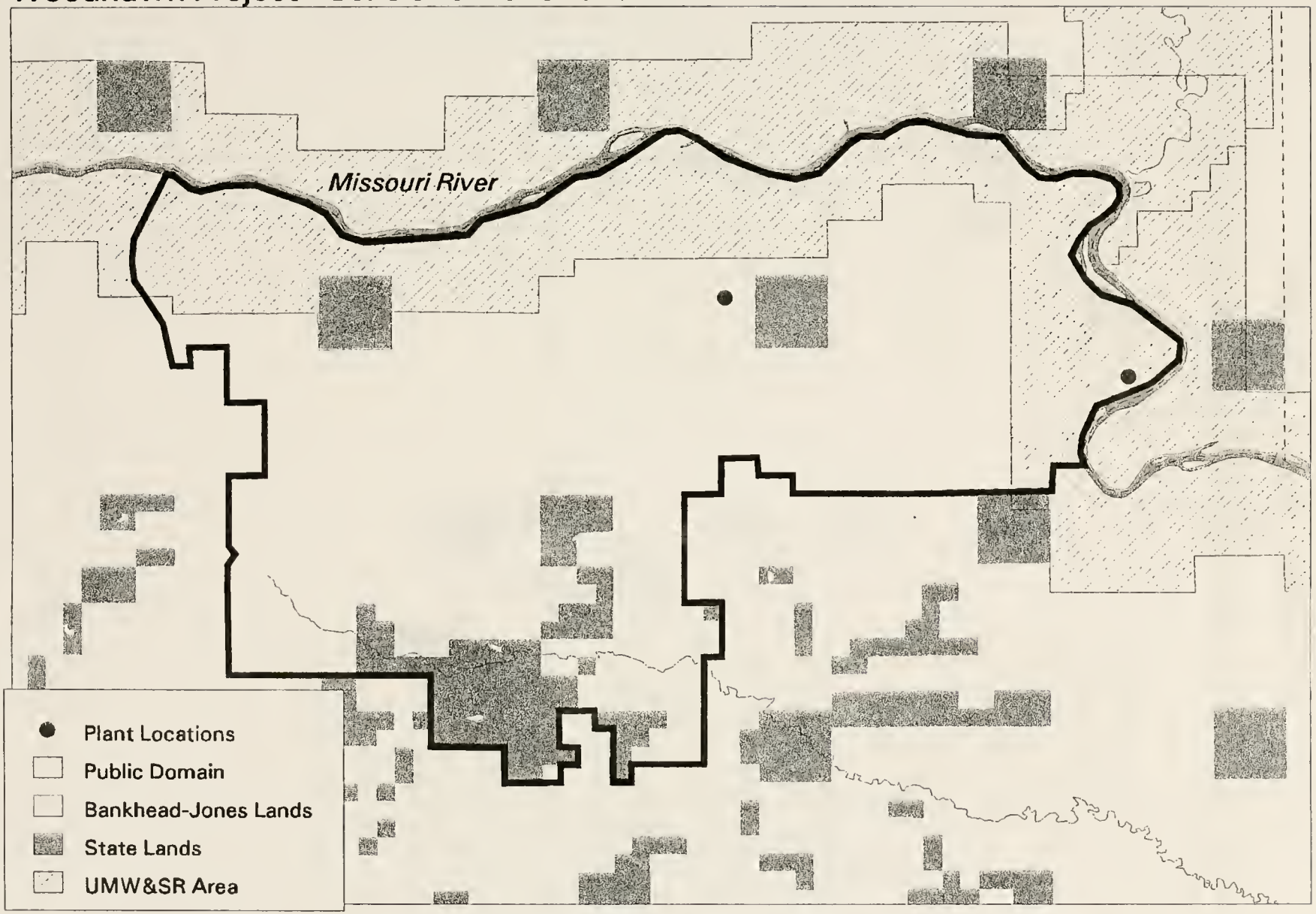
Comments: THE SANDY HABITAT IS UNCOMMON. THIS AREA HAS A LONG HISTORY OF LIVESTOCK GRAZING.

Specimens: NONE.



PSORALEA HYPOGAEA 008
COW ISLAND

Woodhawk Project - Sensitive Plant Locations



Montana Natural Heritage Program, February 20, 1997

Appendix C. ECODATA constancy and cover values by plot and by community type for the Woodhawk study area

Community & Site Numbers

The following list is a cross-reference to the community types and plot numbers which are presented on the following cover synthesis and constancy tables.

Type No.	Plant Association	Plot Nos. (Just the last no. is cited)
1	PSEMEN/ORYMIC	NHMTBTWH96BH0001 NHMTBTWH96BH0004 NHMTBTWH96BH0009 NHMTBTWH96BH0013 NHMTBTWH96BH0015
2	PINPON/CARHEL	NHMTBTWH96BH0010 NHMTBTWH96BH0017 NHMTBTWH96BH0019
3	PINPON/JUNSCO	NHMTBTWH96BH0003 NHMTBTWH96BH0005
4	JUNSCO/ORYMIC	NHMTBTWH96BH0020
5	ARTCAN/AGRSMI	NHMTBTWH96BH0008
6	ARTTSW/AGRSMI	NHMTBTWH96BH0002 NHMTBTWH96BH0014 NHMTBTWH96BH0021
7	ARTTSW/PSEPSI	NHMTBTWH96BH0018
8	ARTLON	NHMTBTWH96BH0016
9	BOUGRA	NHMTBTWH96BH0007 NHMTBTWH96BH0012
10	PSEPSI/POASEC	NHMTBTWH96BH0006
11	STCO/AGSM	NHMTBTWH96BH0011

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	1 *	1 *	1 *	1 *	1 *	2 *	2 *	2 *	3 *	3 *	4 *	5 *	6 *	6 *	6 *
Site	1 *	2 *	3 *	4 *	5 *	6 *	7 *	8 *	9 *	10 *	11 *	12 *	13 *	14 *	15 *
Trees															
JUNSCO	20	30	20	20	30	1	3	3	20	20	80	---	---	---	---
PINPON	---	30	3	1	---	10	30	10	20	20	---	---	---	---	---
PSEMEN	40	50	50	60	40	1	3	1	3	10	3	---	---	---	---
Shrubs															
ARTCAN	---	---	---	---	---	---	---	---	1	---	---	30	---	---	---
ARTFRI	---	---	---	---	---	---	---	---	1	1	---	---	---	---	---
ARTTSW	---	---	---	---	---	---	---	---	---	1	---	---	30	30	30
ATRCON	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ATRGAR	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---
CHRNAU	---	---	---	---	---	---	1	---	---	---	---	---	---	1	---
CHRVIS	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EURLAN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PRUVIR	1	---	---	---	---	---	5	---	---	---	---	---	---	---	---
RIBAME	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---
RIBAUR	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
RIBCER	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
RIBESX	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
RIBSET	1	---	---	---	---	---	---	---	1	---	---	---	---	---	---
ROSWOO	1	---	---	---	1	---	1	---	---	---	---	---	---	---	---
SARVER	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
SYMALB	20	1	10	---	30	---	1	---	---	1	3	---	---	---	---
YUCGLA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Graminoids															
AGRSMI	---	---	---	---	---	---	---	---	---	---	---	20	10	20	20
AGRSPI	1	1	1	1	1	1	3	1	20	20	1	---	---	---	---
BOUGRA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
BROTEC	---	---	---	---	---	---	---	---	---	---	---	---	1	1	1
CALMON	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
CARDEW	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
CARFIL	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
CARHEL	---	3	3	---	1	10	20	20	10	20	1	---	---	---	---
CARSTE	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
KOEMAC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1
ORYMIC	20	10	20	20	20	---	---	---	---	---	10	---	---	---	---
POAJUN	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
POASCA	---	1	---	---	---	---	1	---	---	1	---	---	---	---	---
POASEC	---	---	---	---	---	---	1	---	1	---	1	1	3	1	1

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	1	1	1	1	1	2	2	2	3	3	4	5	6	6	6
Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SPAPEC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
STICOM	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---
STICUR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
STIVIR	---	---	---	---	---	---	---	---	---	---	---	1	1	1	1
Forbs															
ACHMIL	1	1	10	---	1	---	1	---	---	3	1	---	---	1	3
AGRSTR	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ALLTEX	---	1	---	1	1	---	---	---	1	1	1	---	1	1	1
ALYDES	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ANDSEP	---	1	1	---	---	---	---	---	---	---	1	1	---	---	---
ANTMIC	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---
ANTNEG	---	1	---	---	1	---	---	---	1	1	---	---	---	---	---
ARABIS	---	---	---	---	---	---	---	---	---	1	1	---	---	---	---
ARACON	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ARAGLA	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ARAHIR	1	---	1	---	---	---	---	---	---	---	---	---	---	---	---
ARAHOL	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
ARELAT	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ARNSOR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ARTLON	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---
ARTLUD	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ASTAGR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1
ASTERX	---	---	---	---	---	---	1	1	1	1	---	1	---	---	---
ASTLOT	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
CAMROT	---	---	---	1	1	---	---	---	---	---	---	---	---	---	---
CAMSAT	---	---	---	---	---	---	---	---	---	---	---	3	---	---	---
CASSES	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
CERARV	---	---	---	---	1	---	---	---	---	---	1	---	---	---	---
CHEALB	---	---	1	1	---	1	---	---	---	---	---	1	---	---	---
CHELEP	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---
CIRUND	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
COLLIN	---	---	1	---	---	1	---	1	---	1	---	1	---	1	---
COLPAR	1	---	1	1	1	---	---	---	---	---	1	---	---	---	---
COMUMB	---	---	---	---	---	---	---	---	---	---	---	---	1	1	1
CREACU	---	---	---	---	---	---	---	---	1	1	---	---	---	---	---
CREOCC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1
CRYTOR	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---
DESPIN	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
DRABA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DRABAX	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	1	1	1	1	1	2	2	2	3	3	4	5	6	6	6
Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ERIFLA	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---
ERIPUM	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ERYCHE	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ERYREP	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EUPHOR	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---
EUPSPA	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---
FRAVIR	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
GALAPA	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
GAUCOC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
GEUTRI	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---
HACDEF	3	---	---	---	---	---	---	3	---	---	---	---	---	---	---
HAPSPI	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HEDDRU	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
HEDHIS	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LACSER	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LAPRED	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
LATLAT	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LEPDEN	---	---	1	---	---	---	---	---	---	---	---	1	---	---	---
LEPIDI	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
LIAPUN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LINAUS	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LINPER	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---
LINRIG	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
LOMFOE	---	---	---	---	---	---	---	---	---	---	---	---	3	1	1
MACTAN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MELOFF	---	---	---	---	---	---	---	---	---	---	---	10	---	---	---
MICNIG	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MICNUT	---	---	---	---	---	---	---	---	---	1	---	---	---	1	---
MIRLIN	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---
MUSVAG	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---
OPUPOL	---	---	---	---	---	---	---	1	---	1	---	---	1	1	---
OXYSER	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---
PARPEN	10	---	3	20	1	---	---	---	---	---	1	---	---	---	---
PENALB	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PENNIT	---	---	---	---	---	1	---	1	---	---	---	---	---	---	---
PENSTE	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PETALO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PHALIN	---	---	1	---	---	1	---	1	---	1	1	---	---	1	1
PHLHOO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PLAARI	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PLAELO	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	1	1	1	1	1	2	2	2	3	3	4	5	6	6	6
Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
POLDOU	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---
POLYGO	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---
PSOARG	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
PSOHYP	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
RUMVEN	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---
SMIRAC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
SMISTE	1	---	---	---	---	---	---	---	---	---	---	1	---	---	---
SOLIDA	---	---	---	---	1	---	3	---	---	1	1	---	---	---	---
SPHCOC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
STELON	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---
STERUN	---	---	---	1	---	1	---	1	---	---	---	---	---	---	---
STETEN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TARLAE	---	---	---	1	1	---	---	---	---	---	---	1	---	---	---
TAROFF	1	1	---	---	---	---	---	---	1	---	---	---	---	---	---
THERHO	---	---	---	---	---	1	1	1	---	---	---	---	---	---	---
TRADUB	---	---	---	---	---	1	---	---	---	---	---	1	1	---	1
VICAME	---	1	---	---	1	1	1	1	---	3	1	1	1	3	1
VIOADU	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VIONUT	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---
despin	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---
Ferns															
CYSFRA	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
SELDEN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

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* Cover Synthesis Table *

Community	7	8	9	9	10	11
Site	16	17	18	19	20	21
Trees						
JUNSCO	1	---	---	---	---	---
PINPON	---	1	---	---	---	---
PSEMEN	---	---	---	---	---	---
Shrubs						
ARTCAN	---	---	---	---	---	3
ARTFRI	---	---	---	---	10	1
ARTTSW	30	---	---	---	1	---
ATRCON	---	---	3	---	---	---
ATRGAR	---	---	---	---	---	---
CHRNAU	---	---	---	---	---	---
CHRVIS	---	---	---	---	1	---
EURLAN	---	---	---	1	---	---
PRUVIR	---	---	---	---	---	---
RIBAME	---	---	---	---	---	---
RIBAUR	---	---	---	---	---	---
RIBCER	---	---	---	---	1	---
RIBESX	---	---	---	---	---	---
RIBSET	---	---	---	---	---	---
ROSWOO	---	---	---	---	1	---
SARVER	---	---	1	---	---	---
SYMALB	---	---	---	---	---	---
YUCGLA	---	---	---	3	---	1
Graminoids						
AGRSMI	1	---	---	---	---	10
AGRSPI	20	---	---	---	30	---
BOUGRA	---	---	30	20	---	10
BROTEC	1	---	---	---	1	---
CALMON	---	---	---	---	---	---
CARDEW	---	---	---	---	---	---
CARFIL	1	---	---	3	---	1
CARHEL	---	---	---	---	---	---
CARSTE	---	---	---	---	---	---
KOEMAC	1	---	---	1	1	1
ORYMIC	---	---	---	---	---	---
POAJUN	---	---	---	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	7	8	9	9	10	11
Site	16	17	18	19	20	21
POASCA	---	---	---	---	---	---
POASEC	1	---	3	---	10	3
SPAPEC	---	1	---	---	---	---
STICOM	---	---	---	1	3	20
STICUR	---	---	---	---	1	---
STIVIR	---	---	---	---	---	---
Forbs						
ACHMIL	1	---	---	---	10	---
AGRSTR	---	---	---	---	---	---
ALLTEX	---	---	1	1	---	1
ALYDES	---	---	1	---	---	---
ANDSEP	---	---	---	---	---	---
ANTMIC	---	---	---	---	---	---
ANTNEG	---	---	---	---	1	---
ARABIS	---	---	---	---	---	---
ARACON	1	---	---	---	---	---
ARAGLA	---	---	---	---	---	---
ARAHIR	---	---	---	---	---	---
ARAHOL	---	---	---	---	---	---
ARELAT	---	---	---	---	---	---
ARNSOR	---	---	---	---	10	---
ARTLON	---	10	---	---	---	---
ARTLUD	---	---	---	---	---	1
ASTAGR	---	---	---	---	---	---
ASTERX	---	---	---	---	---	1
ASTLOT	---	---	---	1	---	---
CAMROT	---	---	---	---	---	---
CAMSAT	---	---	1	---	---	---
CASSES	---	---	---	1	---	1
CERARV	---	---	---	---	1	---
CHEALB	---	1	---	---	---	---
CHELEP	---	---	---	---	---	---
CIRUND	---	---	---	---	---	1
COLLIN	---	---	---	---	1	---
COLPAR	---	---	---	---	---	---
COMUMB	1	---	---	---	---	---
CREACU	---	---	---	---	1	---
CREOCC	1	---	---	---	---	---
CRYTOR	---	---	---	---	---	---
DESPIN	---	---	---	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	7	8	9	9	10	11
Site	16	17	18	19	20	21
POASCA	---	---	---	---	---	---
POASEC	1	---	3	---	10	3
SPAPEC	---	1	---	---	---	---
STICOM	---	---	---	1	3	20
STICUR	---	---	---	---	1	---
STIVIR	---	---	---	---	---	---
Forbs						
ACHMIL	1	---	---	---	10	---
AGRSTR	---	---	---	---	---	---
ALLTEX	---	---	1	1	---	1
ALYDES	---	---	1	---	---	---
ANDSEP	---	---	---	---	---	---
ANTMIC	---	---	---	---	---	---
ANTNEG	---	---	---	---	1	---
ARABIS	---	---	---	---	---	---
ARACON	1	---	---	---	---	---
ARAGLA	---	---	---	---	---	---
ARAHIR	---	---	---	---	---	---
ARAHOL	---	---	---	---	---	---
ARELAT	---	---	---	---	---	---
ARNSOR	---	---	---	---	10	---
ARTLON	---	10	---	---	---	---
ARTLUD	---	---	---	---	---	1
ASTAGR	---	---	---	---	---	---
ASTERX	---	---	---	---	---	1
ASTLOT	---	---	---	1	---	---
CAMROT	---	---	---	---	---	---
CAMSAT	---	---	1	---	---	---
CASSES	---	---	---	1	---	1
CERARV	---	---	---	---	1	---
CHEALB	---	1	---	---	---	---
CHELEP	---	---	---	---	---	---
CIRUND	---	---	---	---	---	1
COLLIN	---	---	---	---	1	---
COLPAR	---	---	---	---	---	---
COMUMB	1	---	---	---	---	---
CREACU	---	---	---	---	1	---
CREOCC	1	---	---	---	---	---
CRYTOR	---	---	---	---	---	---
DESPIN	---	---	---	---	---	---

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	7	8	9	9	10	11
Site	16	17	18	19	20	21
DRABA	---	---	1	---	---	---
DRABAX	---	---	---	---	---	1
ERIFLA	---	---	---	---	---	---
ERIPUM	---	---	---	1	---	1
ERYCHE	---	---	---	---	---	---
ERYREP	---	---	---	---	---	1
EUPHOR	---	---	---	---	---	---
EUPSPA	---	---	---	---	---	---
FRAVIR	---	---	---	---	---	---
GALAPA	---	---	---	---	---	---
GAUCOC	---	---	---	---	---	1
GEUTRI	---	---	---	---	---	---
HACDEF	---	---	---	---	---	---
HAPSPI	---	---	---	---	---	1
HEDDRU	---	---	1	---	---	---
HEDHIS	---	---	---	---	1	---
LACSER	---	---	---	---	---	---
LAPRED	---	---	1	---	---	---
LATLAT	---	---	---	---	---	---
LEPDEN	---	---	---	---	---	---
LEPIDI	---	---	---	---	---	---
LIAPUN	---	---	---	---	---	1
LINAUS	---	---	1	---	---	1
LINPER	---	---	---	---	---	---
LINRIG	---	---	---	1	---	---
LOMFOE	1	---	---	---	---	---
MACTAN	---	---	1	---	---	---
MELOFF	---	---	1	1	---	---
MICNIG	---	---	---	---	---	1
MICNUT	---	---	---	---	---	---
MIRLIN	---	---	---	---	---	---
MUSVAG	---	---	---	---	---	---
OPUPOL	---	---	3	1	1	1
OXYSER	---	---	---	---	---	---
PARPEN	---	---	---	---	---	---
PENALB	---	---	---	---	---	1
PENNIT	---	1	---	---	---	---
PENSTE	---	---	---	1	---	---
PETALO	---	---	---	---	---	1
PHALIN	1	---	---	---	---	---
PHLHOO	---	---	---	1	---	1
PLAARI	---	---	3	1	---	1

WOODHAWK STUDY AREA: Cover Synthesis Table (species by plot by community type)

Vascular plant species cover to nearest whole percent

Community	7	8	9	9	10	11
Site	16	17	18	19	20	21
PLAELO	---	---	---	---	---	---
POLDOU	---	1	---	---	---	---
POLYGO	---	---	---	---	---	---
PSOARG	---	---	---	---	---	10
PSOHYP	---	---	---	1	---	---
RUMVEN	---	---	---	---	---	---
SMIRAC	---	---	---	---	1	---
SMISTE	---	---	---	---	---	---
SOLIDA	---	---	---	---	---	---
SPHCOC	---	---	---	1	---	1
STELON	---	---	---	---	---	---
STERUN	---	---	---	---	---	---
STETEN	---	1	---	---	---	---
TARLAE	---	---	---	---	---	1
TAROFF	---	---	---	---	---	---
THERHO	---	1	---	---	---	---
TRADUB	---	---	---	---	---	1
VICAME	1	---	---	---	1	1
VIOADU	---	---	---	---	---	---
VIONUT	---	---	---	---	---	---
despin	---	---	---	---	---	---
Ferns						
CYSFRA	---	---	---	---	---	---
SELDEN	---	---	---	---	---	30

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	PSEMEN/ORYMIC N = 5	PINPON/CARHEL N = 3	PINPON/JUNSCO N = 2	JUNSCO/ORYMIC N = 1	ARTCAN/AGRSMI N = 1
Trees					
JUNSCO	100 (24) [20 - 30]	100 (2) [1 - 3]	100 (20) [20 - 20]	100 (80) [80 - 80]	0 (0) [0 - 0]
PINPON	60 (11) [1 - 30]	100 (17) [10 - 30]	100 (20) [20 - 20]	0 (0) [0 - 0]	0 (0) [0 - 0]
PSEMEN	100 (48) [40 - 60]	100 (2) [1 - 3]	100 (7) [3 - 10]	100 (3) [3 - 3]	0 (0) [0 - 0]
Shrubs					
ARTCAN	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	100 (30) [30 - 30]
ARTFRI	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARTTSW	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
ATRCON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ATRGAR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CHRNAU	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CHRVIS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
EURLAN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PRUVIR	20 (1) [1 - 1]	33 (5) [5 - 5]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBAME	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBAUR	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBCER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBESX	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBSET	20 (1) [1 - 1]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
ROSWOO	40 (1) [1 - 1]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SARVER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SYMALB	80 (15) [1 - 30]	33 (1) [1 - 1]	50 (1) [1 - 1]	100 (3) [3 - 3]	0 (0) [0 - 0]
YUCGLA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
Graminoids					
AGRSMI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (20) [20 - 20]
AGRSPI	100 (1) [1 - 1]	100 (2) [1 - 3]	100 (20) [20 - 20]	100 (1) [1 - 1]	0 (0) [0 - 0]
BOUGRA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
BROTEC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CALMON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
CARDEW	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CARFIL	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
CARHEL	60 (2) [1 - 3]	100 (17) [10 - 20]	100 (15) [10 - 20]	100 (1) [1 - 1]	0 (0) [0 - 0]
CARSTE	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
KOEMAC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ORYMIC	100 (18) [10 - 20]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]	0 (0) [0 - 0]
POAJUN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
POASCA	20 (1) [1 - 1]	33 (1) [1 - 1]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	PSEMEN/ORYMIC N = 5	PINPON/CARHEL N = 3	PINPON/JUNSCO N = 2	JUNSCO/ORYMIC N = 1	ARTCAN/AGRSMI N = 1
POASEC	0 (0) [0 - 0]	33 (1) [1 - 1]	50 (1) [1 - 1]	100 (1) [1 - 1]	100 (1) [1 - 1]
SPAPEC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STICOM	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
STICUR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STIVIR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
Forbs					
ACHMIL	80 (3) [1 - 10]	33 (1) [1 - 1]	50 (3) [3 - 3]	100 (1) [1 - 1]	0 (0) [0 - 0]
AGRSTR	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ALLTEX	60 (1) [1 - 1]	0 (0) [0 - 0]	100 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]
ALYDES	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ANDSEP	40 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	100 (1) [1 - 1]
ANTMIC	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ANTNEG	40 (1) [1 - 1]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARABIS	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]
ARACON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAGLA	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAHIR	40 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAHOL	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARELAT	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARNSOR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARTLON	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARTLUD	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ASTAGR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ASTERX	0 (0) [0 - 0]	67 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	100 (1) [1 - 1]
ASTLOT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CAMROT	40 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CAMSAT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (3) [3 - 3]
CASSES	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CERARV	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]
CHEALB	40 (1) [1 - 1]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
CHELEP	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CIRUND	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
COLLIN	20 (1) [1 - 1]	67 (1) [1 - 1]	50 (1) [1 - 1]	0 (0) [0 - 0]	100 (1) [1 - 1]
COLPAR	80 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]
COMUMB	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CREACU	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
CREOCC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CRYTOR	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
DESPIN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
DRABA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	PSEMEN/ORYMIC N = 5	PINPON/CARHEL N = 3	PINPON/JUNSCO N = 2	JUNSCO/ORYMIC N = 1	ARTCAN/AGRSMI N = 1
DRABAX	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERIFLA	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERIPUM	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERYCHE	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERYREP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
EUPHOR	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
EUPSPA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
FRAVIR	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GALAPA	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GAUCOC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GEUTRI	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HACDEF	20 (3) [3 - 3]	33 (3) [3 - 3]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HAPSPI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HEDDRU	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
HEDHIS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LACSER	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LAPRED	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
LATLAT	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LEPDEN	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
LEPIDI	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LIAPUN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LINAUS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LINPER	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
LINRIG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LOMFOE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MACTAN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MELOFF	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]
MICNIG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MICNUT	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
MIRLIN	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MUSVAG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
OPUPOL	0 (0) [0 - 0]	33 (1) [1 - 1]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
OXYSER	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
PARPEN	80 (9) [1 - 20]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]
PENALB	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PENNIT	0 (0) [0 - 0]	67 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PENSTE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PETALO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PHALIN	20 (1) [1 - 1]	67 (1) [1 - 1]	50 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]
PHLHOO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PLAARI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	PSEMEN/ORYMIC N = 5	PINPON/CARHEL N = 3	PINPON/JUNSCO N = 2	JUNSCO/ORYMIC N = 1	ARTCAN/AGRSMI N = 1
PLAELO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
POLDOU	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
POLYGO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
PSOARG	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
PSOHYP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RUMVEN	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SMIRAC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SMISTE	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
SOLIDA	20 (1) [1 - 1]	33 (3) [3 - 3]	50 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]
SPHCOC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STELON	20 (10) [10 - 10]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STERUN	20 (1) [1 - 1]	67 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STETEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
TARLAE	40 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
TAROFF	40 (1) [1 - 1]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
THERHO	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
TRADUB	0 (0) [0 - 0]	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
VICAME	40 (1) [1 - 1]	100 (1) [1 - 1]	50 (3) [3 - 3]	100 (1) [1 - 1]	100 (1) [1 - 1]
VIOADU	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
VIONUT	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
despin	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
Ferns					
CYSFRA	20 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SELDEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	ARTTSW/AGRSMI N = 3	ARTTSW/PSEPSI N = 1	ARTLON N = 1	BOUGRA N = 2	PSEPSI/POASEC N = 1
Trees					
JUNSCO	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PINPON	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
PSEMEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
Shrubs					
ARTCAN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARTFRI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]
ARTTSW	100 (30) [30 - 30]	100 (30) [30 - 30]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
ATRCON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (3) [3 - 3]	0 (0) [0 - 0]
ATRGAR	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CHRNAU	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CHRVIS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
EURLAN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
PRUVIR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBAME	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBAUR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBCER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
RIBESX	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
RIBSET	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ROSWOO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
SARVER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
SYMALB	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
YUCGLA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (3) [3 - 3]	0 (0) [0 - 0]
Graminoids					
AGRSMI	100 (17) [10 - 20]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
AGRSPI	0 (0) [0 - 0]	100 (20) [20 - 20]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (30) [30 - 30]
BOUGRA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (25) [20 - 30]	0 (0) [0 - 0]
BROTEC	100 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
CALMON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CARDEW	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CARFIL	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	50 (3) [3 - 3]	0 (0) [0 - 0]
CARHEL	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CARSTE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
KOEMAC	33 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	50 (1) [1 - 1]	100 (1) [1 - 1]
ORYMIC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
POAJUN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
POASCA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	ARTTSW/AGRSMI N = 3	ARTTSW/PSEPSI N = 1	ARTLON N = 1	BOUGRA N = 2	PSEPSI/POASEC N = 1
POASEC	100 (2) [1 - 3]	100 (1) [1 - 1]	0 (0) [0 - 0]	50 (3) [3 - 3]	100 (10) [10 - 10]
SPAPEC	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
STICOM	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	100 (3) [3 - 3]
STICUR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
STIVIR	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
Forbs					
ACHMIL	67 (2) [1 - 3]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]
AGRSTR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ALLTEX	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]
ALYDES	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
ANDSEP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ANTMIC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ANTNEG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
ARABIS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARACON	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAGLA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAHIR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARAHOL	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARELAT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARNSOR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]
ARTLON	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (10) [10 - 10]	0 (0) [0 - 0]	0 (0) [0 - 0]
ARTLUD	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ASTAGR	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ASTERX	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ASTLOT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
CAMROT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CAMSAT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
CASSES	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
CERARV	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
CHEALB	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
CHELEP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CIRUND	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
COLLIN	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
COLPAR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
COMUMB	100 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CREACU	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
CREOCC	33 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
CRYTOR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
DESPIN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
DRABA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
DRABAX	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	ARTTSW/AGRSMI N = 3	ARTTSW/PSEPSI N = 1	ARTLON N = 1	BOUGRA N = 2	PSEPSI/POASEC N = 1
ERIFLA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERIPUM	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
ERYCHE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
ERYREP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
EUPHOR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
EUPSPA	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
FRAVIR	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GALAPA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GAUCOC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
GEUTRI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HACDEF	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HAPSPI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
HEDDRU	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
HEDHIS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
LACSER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LAPRED	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
LATLAT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LEPDEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LEPIDI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LIAPUN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LINAUS	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
LINPER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
LINRIG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
LOMFOE	100 (2) [1 - 3]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MACTAN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
MELOFF	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]
MICNIG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MICNUT	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MIRLIN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
MUSVAG	33 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
OPUPOL	67 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (2) [1 - 3]	100 (1) [1 - 1]
OXYSER	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PARPEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PENALB	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PENNIT	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
PENSTE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
PETALO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PHALIN	67 (1) [1 - 1]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PHLHOO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
PLAARI	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (2) [1 - 3]	0 (0) [0 - 0]
PLAELO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
POLDOU	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community	ARTTSW/AGRSMI	ARTTSW/PSEPSI	ARTLON	BOUGRA	PSEPSI/POASEC
# Sites	N = 3	N = 1	N = 1	N = 2	N = 1
POLYGO	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PSOARG	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
PSOHYP	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
RUMVEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SMIRAC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
SMISTE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SOLIDA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SPHCOC	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	50 (1) [1 - 1]	0 (0) [0 - 0]
STELON	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STERUN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
STETEN	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
TARLAE	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
TAROFF	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
THERHO	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]
TRADUB	67 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
VICAME	100 (2) [1 - 3]	100 (1) [1 - 1]	0 (0) [0 - 0]	0 (0) [0 - 0]	100 (1) [1 - 1]
VIOADU	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
VIONUT	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
despin	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
Ferns					
CYSFRA	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]
SELDEN	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

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Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community	STCO/AGSM
# Sites	N = 1
Trees	
JUNSCO	0 (0) [0 - 0]
PINPON	0 (0) [0 - 0]
PSEMEN	0 (0) [0 - 0]
Shrubs	
ARTCAN	100 (3) [3 - 3]
ARTFRI	100 (1) [1 - 1]
ARTTSW	0 (0) [0 - 0]
ATRCON	0 (0) [0 - 0]
ATRGAR	0 (0) [0 - 0]
CHRNAU	0 (0) [0 - 0]
CHRVIS	0 (0) [0 - 0]
EURLAN	0 (0) [0 - 0]
PRUVIR	0 (0) [0 - 0]
RIBAME	0 (0) [0 - 0]
RIBAUR	0 (0) [0 - 0]
RIBCER	0 (0) [0 - 0]
RIBESX	0 (0) [0 - 0]
RIBSET	0 (0) [0 - 0]
ROSWOO	0 (0) [0 - 0]
SARVER	0 (0) [0 - 0]
SYMALB	0 (0) [0 - 0]
YUCGLA	100 (1) [1 - 1]
Graminoids	
AGRSMI	100 (10) [10 - 10]
AGRSPI	0 (0) [0 - 0]
BOUGRA	100 (10) [10 - 10]
BROTEC	0 (0) [0 - 0]
CALMON	0 (0) [0 - 0]
CARDEW	0 (0) [0 - 0]
CARFIL	100 (1) [1 - 1]
CARHEL	0 (0) [0 - 0]
CARSTE	0 (0) [0 - 0]
KOEMAC	100 (1) [1 - 1]
ORYMIC	0 (0) [0 - 0]
POAJUN	0 (0) [0 - 0]
POASCA	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	STCO/AGSM N = 1
POASEC	100 (3) [3 - 3]
SPAPEC	0 (0) [0 - 0]
STICOM	100 (20) [20 - 20]
STICUR	0 (0) [0 - 0]
STIVIR	0 (0) [0 - 0]
Forbs	
ACHMIL	0 (0) [0 - 0]
AGRSTR	0 (0) [0 - 0]
ALLTEX	100 (1) [1 - 1]
ALYDES	0 (0) [0 - 0]
ANDSEP	0 (0) [0 - 0]
ANTMIC	0 (0) [0 - 0]
ANTNEG	0 (0) [0 - 0]
ARABIS	0 (0) [0 - 0]
ARACON	0 (0) [0 - 0]
ARAGLA	0 (0) [0 - 0]
ARAHIR	0 (0) [0 - 0]
ARAHOL	0 (0) [0 - 0]
ARELAT	0 (0) [0 - 0]
ARNSOR	0 (0) [0 - 0]
ARTLON	0 (0) [0 - 0]
ARTLUD	100 (1) [1 - 1]
ASTAGR	0 (0) [0 - 0]
ASTERX	100 (1) [1 - 1]
ASTLOT	0 (0) [0 - 0]
CAMROT	0 (0) [0 - 0]
CAMSAT	0 (0) [0 - 0]
CASSES	100 (1) [1 - 1]
CERARV	0 (0) [0 - 0]
CHEALB	0 (0) [0 - 0]
CHELEP	0 (0) [0 - 0]
CIRUND	100 (1) [1 - 1]
COLLIN	0 (0) [0 - 0]
COLPAR	0 (0) [0 - 0]
COMUMB	0 (0) [0 - 0]
CREACU	0 (0) [0 - 0]
CREOCC	0 (0) [0 - 0]
CRYTOR	0 (0) [0 - 0]
DESPIN	0 (0) [0 - 0]
DRABA	0 (0) [0 - 0]
DRABAX	100 (1) [1 - 1]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community # Sites	STCO/AGSM N = 1
ERIFLA	0 (0) [0 - 0]
ERIPUM	100 (1) [1 - 1]
ERYCHE	0 (0) [0 - 0]
ERYREP	100 (1) [1 - 1]
EUPHOR	0 (0) [0 - 0]
EUPSPA	0 (0) [0 - 0]
FRAVIR	0 (0) [0 - 0]
GALAPA	0 (0) [0 - 0]
GAUCOC	100 (1) [1 - 1]
GEUTRI	0 (0) [0 - 0]
HACDEF	0 (0) [0 - 0]
HAPSPI	100 (1) [1 - 1]
HEDDRU	0 (0) [0 - 0]
HEDHIS	0 (0) [0 - 0]
LACSER	0 (0) [0 - 0]
LAPRED	0 (0) [0 - 0]
LATLAT	0 (0) [0 - 0]
LEPDEN	0 (0) [0 - 0]
LEPIDI	0 (0) [0 - 0]
LIAPUN	100 (1) [1 - 1]
LINAUS	100 (1) [1 - 1]
LINPER	0 (0) [0 - 0]
LINRIG	0 (0) [0 - 0]
LOMFOE	0 (0) [0 - 0]
MACTAN	0 (0) [0 - 0]
MELOFF	0 (0) [0 - 0]
MICNIG	100 (1) [1 - 1]
MICNUT	0 (0) [0 - 0]
MIRLIN	0 (0) [0 - 0]
MUSVAG	0 (0) [0 - 0]
OPUPOL	100 (1) [1 - 1]
OXYSER	0 (0) [0 - 0]
PARPEN	0 (0) [0 - 0]
PENALB	100 (1) [1 - 1]
PENNIT	0 (0) [0 - 0]
PENSTE	0 (0) [0 - 0]
PETALO	100 (1) [1 - 1]
PHALIN	0 (0) [0 - 0]
PHLHOO	100 (1) [1 - 1]
PLAARI	100 (1) [1 - 1]
PLAELO	0 (0) [0 - 0]
POLDOU	0 (0) [0 - 0]

WOODHAWK STUDY AREA: Cover Constancy Table (species by community type)

Vascular plant species cover to nearest whole percent

Cover Constancy Table: Constancy (Average Abund) [Range, Minimum - Maximum]

Community	STCO/AGSM
# Sites	N = 1
POLYGO	0 (0) [0 - 0]
PSOARG	100 (10) [10 - 10]
PSOHYP	0 (0) [0 - 0]
RUMVEN	0 (0) [0 - 0]
SMIRAC	0 (0) [0 - 0]
SMISTE	0 (0) [0 - 0]
SOLIDA	0 (0) [0 - 0]
SPHCOC	100 (1) [1 - 1]
STELON	0 (0) [0 - 0]
STERUN	0 (0) [0 - 0]
STETEN	0 (0) [0 - 0]
TARLAE	100 (1) [1 - 1]
TAROFF	0 (0) [0 - 0]
THERHO	0 (0) [0 - 0]
TRADUB	100 (1) [1 - 1]
VICAME	100 (1) [1 - 1]
VIOADU	0 (0) [0 - 0]
VIONUT	0 (0) [0 - 0]
despin	0 (0) [0 - 0]
Ferns	
CYSFRA	0 (0) [0 - 0]
SELDEN	100 (30) [30 - 30]

Appendix D - Preliminary list of vascular plants in the Woodhawk study area

Preliminary Vascular Flora of the Woodhawk Study Area

Scientific Name	FAMILY
ACHILLEA MILLEFOLIUM	ASTERACEAE
ACROPTILON REPENS	ASTERACEAE
AGROPYRON CRISTATUM	POACEAE
AGROSTIS SCABRA	POACEAE
ALISMA TRIVIALE	ALISMATACEAE
ALLIUM TEXTILE	LILIACEAE
ALOPECURUS AEQUALIS	POACEAE
ALYSSUM DESERTORUM	BRASSICACEAE
AMARANTHUS ALBUS	AMARANTHACEAE
AMBROSIA ARTEMISIIFOLIA	ASTERACEAE
ANDROSACE SEPTENTRIONALIS	PRIMULACEAE
ANTENNARIA DIMORPHA	ASTERACEAE
ANTENNARIA MICROPHYLLA	ASTERACEAE
ANTENNARIA NEGLECTA	ASTERACEAE
ANTENNARIA PARVIFOLIA	ASTERACEAE
APOCYNUM ANDROSAEMIFOLIUM	APOCYNACEAE
AQUILEGIA FLAVESCENS	RANUNCULACEAE
ARISTIDA PURPUREA	POACEAE
ARNICA SORORIA	ASTERACEAE
ARTEMISIA CAMPESTRIS	ASTERACEAE
ARTEMISIA CANA	ASTERACEAE
ARTEMISIA FRIGIDA	ASTERACEAE
ARTEMISIA LONGIFOLIA	ASTERACEAE
ARTEMISIA LUDOVICIANA	ASTERACEAE
ARTEMISIA TRIDENTATA SSP. VASEYANA	ASTERACEAE
ASCLEPIAS ~~STENOPHYLLA~~ VIRIDIFLORA	ASCLEPIADACEAE

Scientific Name	FAMILY
ASTER SPP.	ASTERACEAE
ASTRAGALUS ADSURGENS	FABACEAE
ASTRAGALUS AGRESTIS	FABACEAE
ASTRAGALUS BISULCATUS	FABACEAE
ASTRAGALUS GILVIFLORUS	FABACEAE
ASTRAGALUS LOTIFLORUS	FABACEAE
ASTRAGALUS MISSOURIENSIS	FABACEAE
ASTRAGALUS PECTINATUS ASTRAGALUS TENELLUS	FABACEAE
ATRIPLEX ARGENTEA	CHENOPODIACEAE
ATRIPLEX CONFERTIFOLIA	CHENOPODIACEAE
ATRIPLEX GARDNERI	CHENOPODIACEAE
BESSEYA WYOMINGENSIS	SCROPHULARIACEAE
BOUTELOUA GRACILIS	POACEAE
BRASSICA NIGRA	BRASSICACEAE
BROMUS BRIZAEFORMIS BROMUS INERMIS	POACEAE
BROMUS TECTORUM	POACEAE
CALAMAGROSTIS MONTANENSIS	POACEAE
CALAMOVILFA LONGIFOLIA	POACEAE
CALLITRICHE HERMAPHRODITICA	CALLITRICHACEAE
CAMELINA SATIVA	BRASSICACEAE
CAMPANULA ROTUNDIFOLIA	CAMPANULACEAE
CAPSELLA BURSA-PASTORIS	BRASSICACEAE
CAREX AQUATILIS	CYPERACEAE
CAREX BREVIOR CAREX DEWEYANA	CYPERACEAE
CAREX DURIUSCULA	CYPERACEAE
CAREX FILIFOLIA	CYPERACEAE
CAREX PENSYLVANICA	CYPERACEAE
CAREX PRAEGRACILIS	CYPERACEAE

Scientific Name	FAMILY
CAREX ROSSII	CYPERACEAE
CASTILLEJA SESSILIFLORA	SCROPHULARIACEAE
CERASTIUM ARVENSE	CARYOPHYLLACEAE
CERATOIDES LANATA	CHENOPODIACEAE
CHAENACTIS DOUGLASII	ASTERACEAE
CHENOPODIUM ALBUM	CHENOPODIACEAE
CHENOPODIUM RUBRUM	CHENOPODIACEAE
CHRYSOTHAMNUS NAUSEOSUS	ASTERACEAE
CHRYSOTHAMNUS VISCIDIFLORUS	ASTERACEAE
CIRSIUM ARVENSE	ASTERACEAE
CIRSIUM UNDULATUM	ASTERACEAE
CIRSIUM SPP.	
CLEMATIS OCCIDENTALIS	RANUNCULACEAE
COLLINSIA PARVIFLORA	SCROPHULARIACEAE
COLLOMIA LINEARIS	POLEMONIACEAE
COMANDRA UMBELLATA	SANTALACEAE
CONRINGIA ORIENTALIS	
CONVOLVULUS ARVENSIS	CONVOLVULACEAE
CONYZA CANADENSIS	ASTERACEAE
CREPIS ACUMINATA	ASTERACEAE
CREPIS OCCIDENTALIS	ASTERACEAE
CRYPTANTHA TORREYANA	BORAGINACEAE
CYMOPTERUS ACAULIS	APIACEAE
CYSTOPTERIS FRAGILIS	POLYPODIACEAE
DALEA SPP.	FABACEAE
DANTHONIA UNISPICATA	POACEAE
DESCURAINIA INCANA	BRASSICACEAE
DISTICHILIS STRICTA	POACEAE
DODECATHEON CONJUGENS	PRIMULACEAE
DRABA NEMOROSA	BRASSICACEAE

Scientific Name	FAMILY
DRABA REPTANS	BRASSICACEAE
ELATINE AMERICANA	ELATINACEAE
ELEOCHARIS PALUSTRIS	CYPERACEAE
ELYMUS CANADENSIS	POACEAE
ELYMUS GLAUCUS	POACEAE
ELYTRIGIA REPENS =AGROPYRON "	POACEAE
EQUISETUM ARVENSE	EQUISETACEAE
EQUISETUM LAEVIGATUM	EQUISETACEAE
ERIGERON PUMILUS	ASTERACEAE
ERIOGONUM FLAVUM	POLYGONACEAE
ERYSIMUM CHEIRANTHOIDES	BRASSICACEAE
EUPHORBIA ESULA	EUPHORBIACEAE
EUPHORBIA SPATHULATA	EUPHORBIACEAE
FRAGARIA VIRGINIANA	ROSACEAE
FRAXINUS PENNSYLVANICA	OLEACEAE
FRITILLARIA ATROPURPUREA	LILIACEAE
GALIUM APARINE	RUBIACEAE
GAURA COCCINEA	ONAGRACEAE
GNAPHALIUM PALUSTRE	ASTERACEAE
GRATIOLA EBRACTEATA	SCROPHULARIACEAE
GRINDELIA SQUARROSA	ASTERACEAE
GUTIERREZIA SAROTHRAE	ASTERACEAE
HACKELIA DEFLEXA	BORAGINACEAE
HACKELIA FLORIBUNDA	BORAGINACEAE
HAPLOPAPPUS ACAULIS HAPLOPAPPUS MULTICAULIS	ASTERACEAE
HEDEOMA DRUMMONDII	LAMIACEAE
HELIANTHUS NUTTALLII	ASTERACEAE
HELIANTHUS PETIOLARIS	ASTERACEAE

Scientific Name	FAMILY
HEUCHERA PARVIFOLIA	SAXIFRAGACEAE
HORDEUM JUBATUM HORDEUM PUSILLUM	POACEAE
HYMENOPAPPUS FILIFOLIUS	ASTERACEAE
HYMENOXYS ACAULIS	ASTERACEAE
HYMENOXYS RICHARDSONII	ASTERACEAE
ISOETES NUTTALLII	ISOETACEAE
IVA AXILLARIS	ASTERACEAE
JUNCUS BALTICUS	JUNCACEAE
JUNCUS BUFONIUS	JUNCACEAE
JUNCUS TENUIS	JUNCACEAE
~~JUNIPERUS HORIZONTALIS~~	~~CUPRESSACEAE~~
JUNIPERUS SCOPULORUM	CUPRESSACEAE
KOCHIA SCOPARIA	CHENOPODIACEAE
KOELERIA MACRANTHA	POACEAE
LACTUCA BIENNIS	ASTERACEAE
LAPPULA OCCIDENTALIS	BORAGINACEAE
LEPIDIUM CAMPESTRE	BRASSICACEAE
LEPIDIUM ~~CAMPESTRE~~ DENSIFLORUM	BRASSICACEAE
LEPIDIUM PERFOLIATUM	BRASSICACEAE
LESQUERELLA ALPINA	BRASSICACEAE
LIATRIS PUNCTATA	ASTERACEAE
LIMOSELLA AQUATICA	SCROPHULARIACEAE
LINUM AUSTRALE	LINACEAE
LINUM LEWISII	LINACEAE
LOMATIUM FOENICULACEUM	APIACEAE
LUPINUS LEPIDUS	FABACEAE
LYCOPUS AMERICANUS	LAMIACEAE
LYGODESMIA JUNCEA	ASTERACEAE

Scientific Name	FAMILY
MACHAEANTHERA PINNATIFIDA	ASTERACEAE
MACHAERANTHERA CANESCENS	ASTERACEAE
MACHAERANTHERA TANACETIFOLIA	ASTERACEAE
MAHONIA REPENS	BERBERIDACEAE
MAIANTHEMUM STELLATUM	LILIACEAE
MEDICAGO LUPULINA	FABACEAE
MELILOTUS OFFICINALIS	FABACEAE
MENTZELIA DISPERSA	LOASACEAE
MIRABILIS LINEARIS	NYCTAGINACEAE
MONARDA FISTULOSA	LAMIACEAE
MONOLEPIS NUTTALLIANA	CHENOPODIACEAE
MUSINEON VAGINATUM	APIACEAE
MYOSURUS ARISTATUS	RANUNCULACEAE
NOTHOCALAIS CUSPIDATA	ASTERACEAE
OENOTHERA PERENNIS	ONAGRACEAE
OPUNTIA POLYACANTHA	CACTACEAE
OROBANCHE FASCICULATA	OROBANCHACEAE
OROBANCHE UNIFLORA	OROBANCHACEAE
ORTHOCARPUS LUTEUS	SCROPHULARIACEAE
ORYZOPSIS HYMENOIDES	POACEAE
ORYZOPSIS MICRANTHA	POACEAE
OSMORHIZA DEPAUPERATA	APIACEAE
OXYTROPIS LAMBERTII	FABACEAE
OXYTROPIS SERICEA	FABACEAE
PARIETARIA PENSYLVANICA	URTICACEAE
PARONYCHIA SESSILIFLORA	CARYOPHYLLACEAE
PASCOPYRUM SMITHII = AGROPYRON	POACEAE
PENSTEMON ALBIDUS	SCROPHULARIACEAE

Scientific Name	FAMILY
PENSTEMON NITIDUS	SCROPHULARIACEAE
PHACELIA SPP.	BORAGINACEAE
PHLEUM PRATENSE	POACEAE
PHLOX HOODII	POLEMONIACEAE
PINUS PONDEROSA	PINACEAE
PLANTAGO ARISTATA	PLANTAGINACEAE
PLANTAGO CANESCENS	PLANTAGINACEAE
PLANTAGO ELONGATA	PLANTAGINACEAE
PLANTAGO MAJOR	PLANTAGINACEAE
PLANTAGO PATAGONICA	PLANTAGINACEAE
POA PALUSTRIS	POACEAE
POA PRATENSIS	POACEAE
POA SECUNDA	POACEAE
POLYGONUM DOUGLASII, P. ACHOREUM	
POPULUS DELTOIDES	SALICACEAE
POTAMOGETON PECTINATUS	
POTENTILLA ANSERINA	ROSACEAE
POTENTILLA ARGUTA	ROSACEAE
POTENTILLA GRACILIS	ROSACEAE
PRUNUS VIRGINIANA	ROSACEAE
PSEUDOREGNERIA SPICATA	POACEAE
PSEUDOTSUGA MENZIESII	PINACEAE
PSORALEA ARGOPHYLLA	
PSORALEA ESCULENTA	FABACEAE
PSORALEA HYPOGAEA	FABACEAE
PUCCINNELLIA NUTTALLIANA	POACEAE
PULSATILLA PATENS	RANUNCULACEAE
RANUNCULUS ABORTIVUS	RANUNCULACEAE
RANUNCULUS AQUATILIS	RANUNCULACEAE
RATIBIDA COLUMNIFERA	ASTERACEAE
RHUS TRILOBATA	ANACARDIACEAE

Scientific Name	FAMILY
RIBES CEREUM	GROSSULARIACEAE
RORIPPA SINUATA	BRASSICACEAE
ROSA ARKANSANA	ROSACEAE
RUMEX CRISPUS	POLYGONACEAE
RUMEX VENOSUS	POLYGONACEAE
RUPPIA MARITIMA	RUPPIACEAE
SALICORNIA RUBRA	CHENOPODIACEAE
SALIX AMYGDALOIDES	SALICACEAE
SALIX LUCIDA	SALICACEAE
SALSOLA AUSTRALIS	CHENOPODIACEAE
SARCOBATUS VERMICULATUS	CHENOPODIACEAE
SCIRPUS AMERICANUS	CYPERACEAE
SCIRPUS MARITIMUS	CYPERACEAE
SELAGINELLA DENSA	SELAGINACEAE
SENECIO SPP.	ASTERACEAE
SILENE SPP.	CARYOPHYLLACEAE
SISYMBRIUM ALTISSIMUM	BRASSICACEAE
SISYMBRIUM LOESELII	BRASSICACEAE
SISYRINCHIUM MONTANUM	IRIDACEAE
SITANION HYSTRIX	POACEAE
SOLIDAGO MISSOURIENSIS	ASTERACEAE
SOLIDAGO RIGIDA	ASTERACEAE
SONCHUS ASPER	ASTERACEAE
SPARTINA GRACILIS	POACEAE
SPARTINA PECTINATA	POACEAE
SPHAERALCEA COCCINEA	MALVACEAE
SPOROBOLUS AIROIDES	POACEAE
STELLARIA LONGIFOLIA	CARYOPHYLLACEAE

Scientific Name	FAMILY
STENOTUS ACAULIS	ASTERACEAE
STEPHANOMERIA RUNCINATA	ASTERACEAE
STIPA COMATA	POACEAE
STIPA CURTISETA	POACEAE
STIPA VIRIDULA	POACEAE
SYMPHORICARPOS ALBUS	CAPRIFOLIACEAE
~~TAMARIX CHINENSIS~~ Not Found!	~~TAMARICACEAE~~
TARAXACUM OFFICINALE	ASTERACEAE
THELESPERMA MARGINATUM	ASTERACEAE
THERMOPSIS RHOMBIFOLIA	FABACEAE
TOWNSENDIA HOOKERI	ASTERACEAE
TRAGOPOGON DUBIUS	ASTERACEAE
TRIGLOCHIN CONCINNUM VAR DEBILE	JUNCAGINACEAE
TYPHA ANGUSTIFOLIA	TYPHACEAE
URTICA DIOICA	URTICACEAE
VERONICA PEREGRINA	SCROPHULARIACEAE
VICIA AMERICANA	FABACEAE
VIOLA ADUNCA	VIOLACEAE
VULPIA OCTOFLORA = FESTUCA	POACEAE
XANTHIUM STRUMARIUM	ASTERACEAE
YUCCA GLAUCA	AGAVACEAE
ZANICHELLIA PALUSTRIS	ZANNICHELLIACEAE

Appendix E - Community type photos

Woodhawk Creek valley

Typical Woodhawk Tributary headwaters

PSEMEN/ORYMIC p.a. (Plot 001)

PSEMEN/ORYMIC p.a. (Plot 004)

PSEMEN/JUNSCO p.a. (Plot 003)

PSEMEN/JUNSCO p.a. (Plot 005)

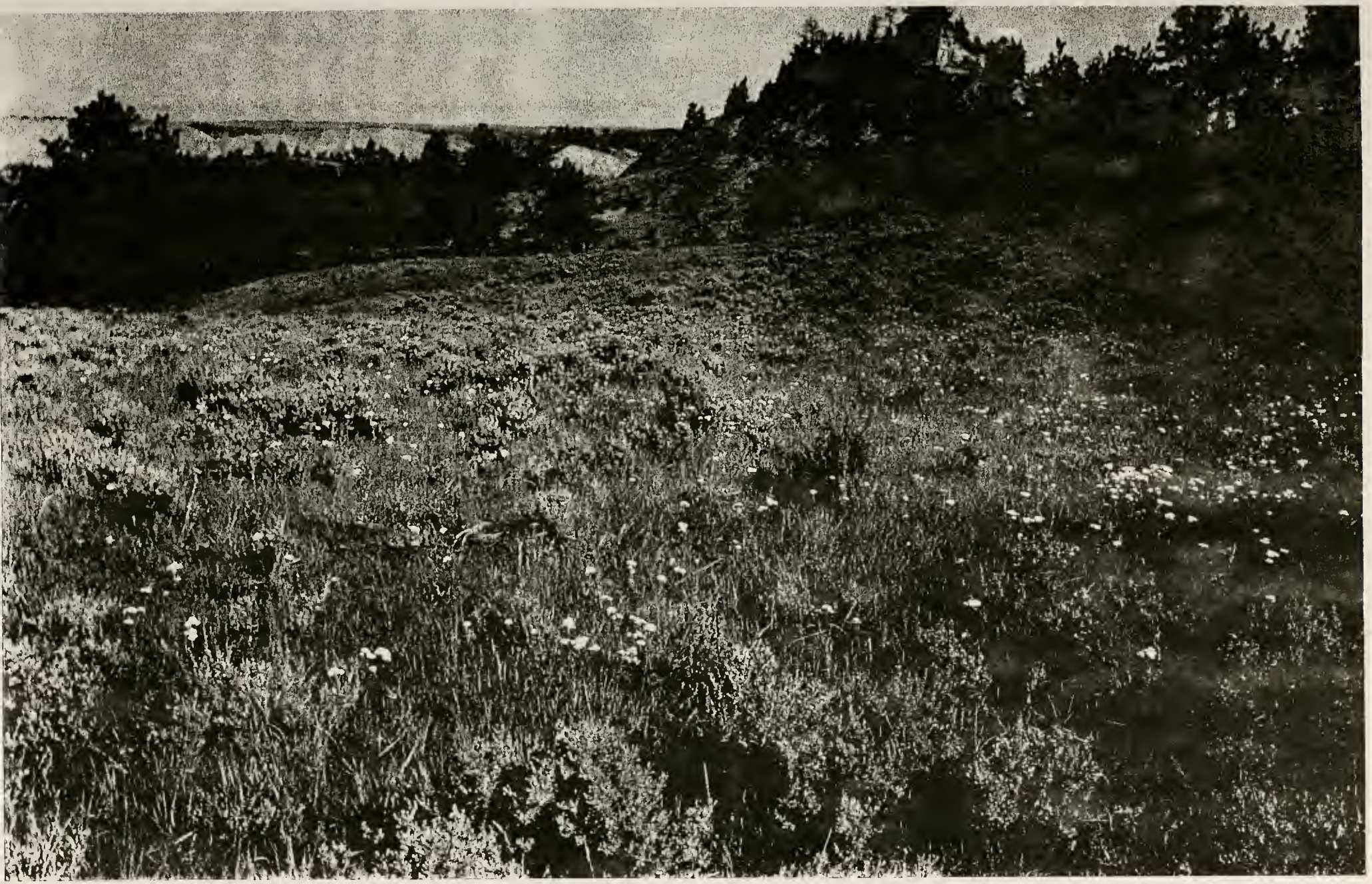
PINPON/CARHEL p.a. (Plot 019)

JUNSCO/ORYMIC p.a. (Plot 023)

JUNSCO. (Green and glaucous forms)

ARTTSW/AGRSMI in poor condition (Plot 002)

ARTSW/AGRSMI in good condition (Plot 014)

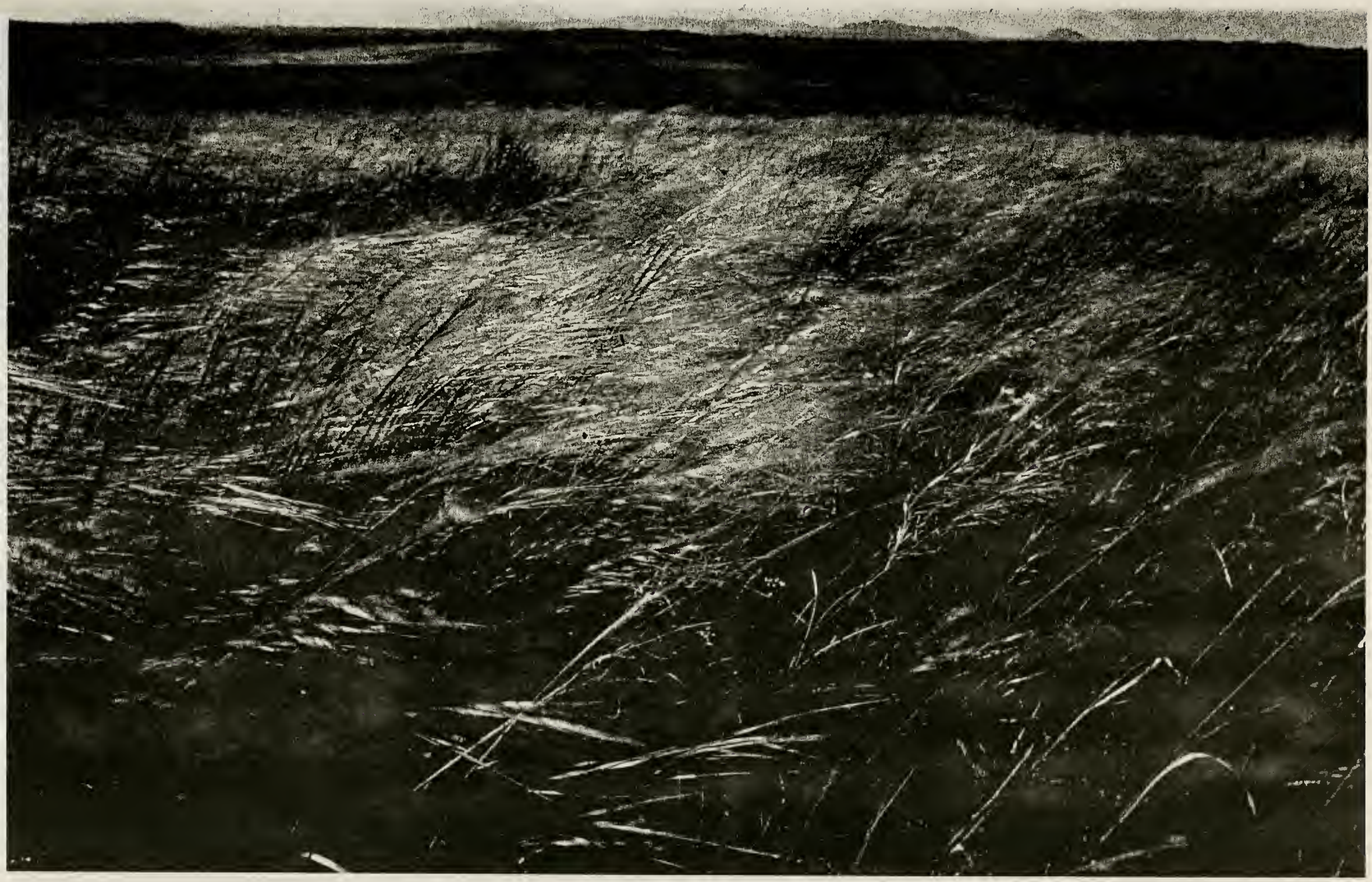


ARTTSW/AGRSMI in good condition (Plot 021)

ARTTR/AGRSPI (Plot 018)

ARTLON p.a. (foreground)

STICOM-AGRSMI p.a. (Plot 011)

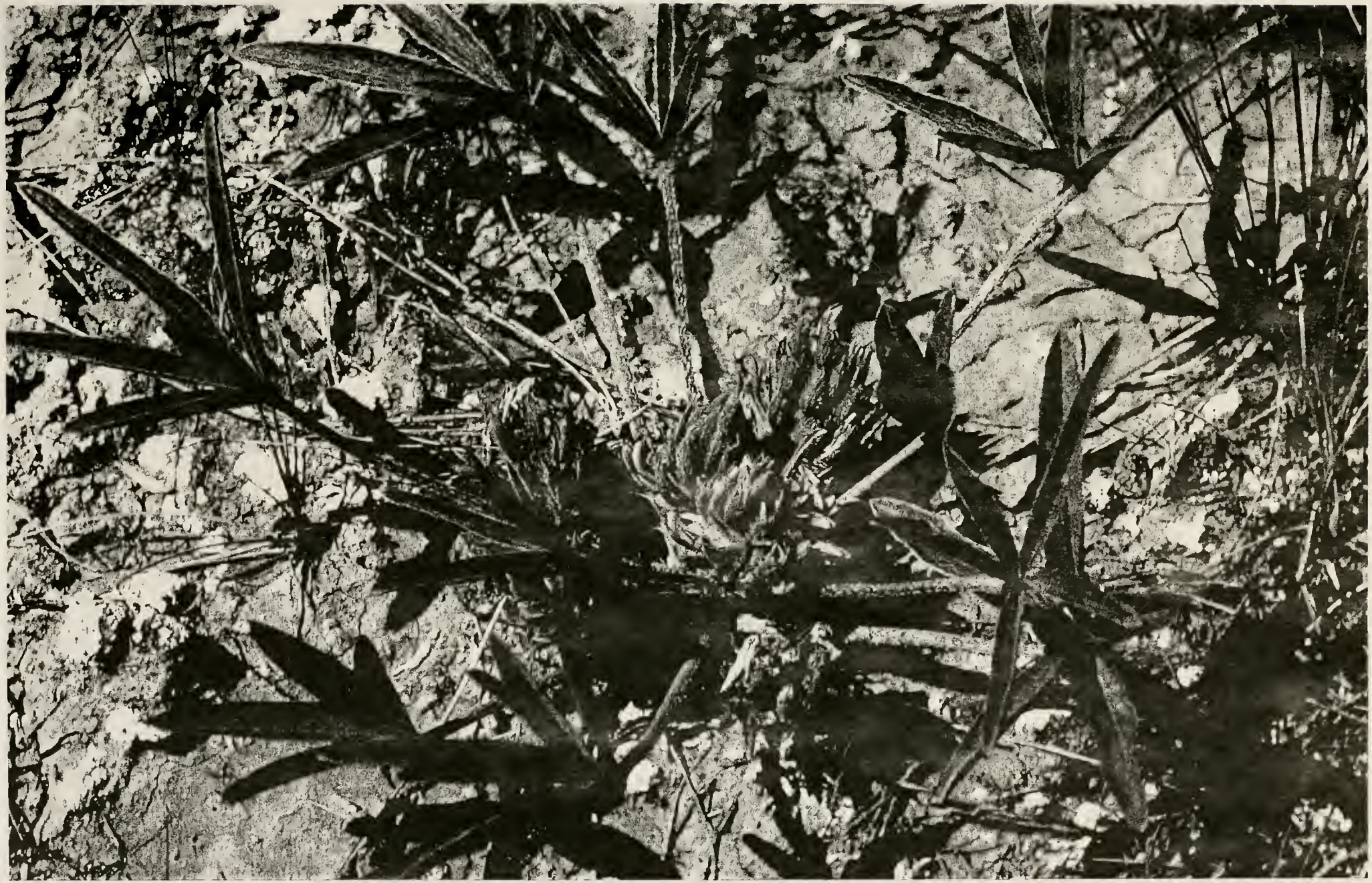


STICOM-AGRSMI p.a. on Reppe Butte

ELEPAL p.a.

SCIMAR p.a.

Appendix F - Sensitive plant photos and illustrations



Psoralea hypogaea (close-up)

Psoralea hypogaea (BOUGRA p.a. Plot 012)

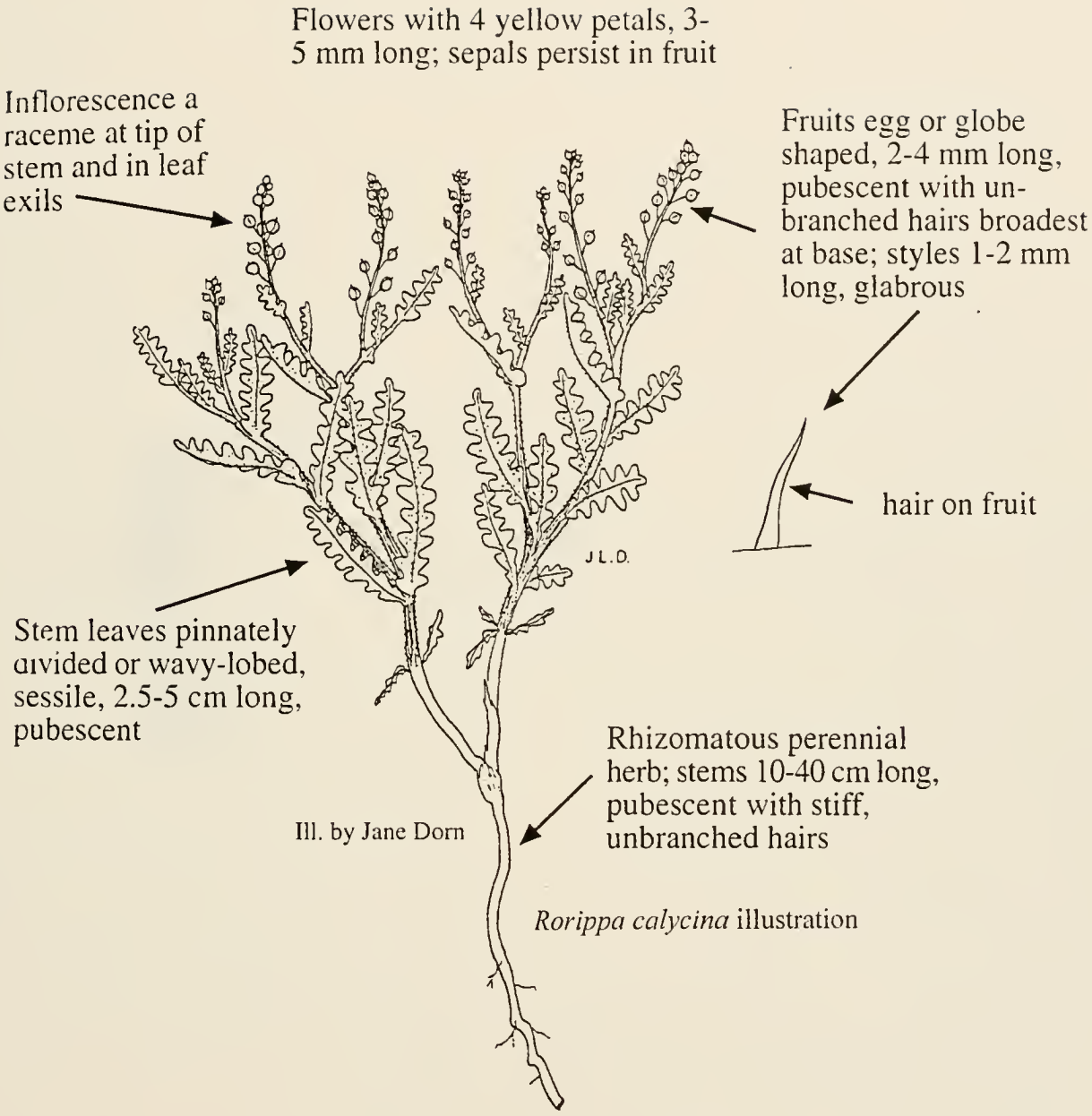
Psoralea hypogaea (sandstone ridge slope habitat)

Rorippa sinuata (the common species; close-up)

Rorippa sinuata (whole plant)

Rorippa sinuata

Rorippa sinuata illustration



Rorippa calycina illustration